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Across Wadai . . . . . Sir Philip Brocklehurst 233
Archæology and the Ordnance Survey . . O. G. S. Crawford 245
The Emperor Kang Hsi's Edict on Mountains and Rivers of China W. R. Carles 258
The Economic Life of the Baffin Island Eskimo . Henry Toke Munn 269
Stereographic Survey: the Stereoautograph . . Arthur R. Hinks 273
Stereographic Survey: the Autocartograph Lieut.-Col. M. N. MacLeod 284
The International Hydrographic Bureau 293
Reviews The Monthly Record Obituary Correspondence Meetings of the Society
Contents v
Society Notices vi

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The Geographical Journal

Vol. LIX No. 4 April 1922

ACROSS WADAI

Sir Philip Brocklehurst, Bart.

Read at the Meeting of the Society, 9 January 1922.

WADAI is the Northern District of French Equatorial Africa, lying between the Anglo-Egyptian Sudan on the east, Nigeria on the west, and the Sahara and Lybian deserts to the north. With the events which led to the occupation of Wadai by the French at the beginning of the twentieth century the recent history of Darfur, the Western Province of the Anglo-Egyptian Sudan, is closely connected. Prior to the Mahdi rising in 1881 Darfur was under the administration of Egypt, but joined the forces of the Mahdi, and later those of the Khalifa Abdullahi. On the eve of the battle of Omdurman Ali Dinar, a Darfurian and one of the emirs of the Khalifa, deserted the Dervish forces, and returning to El Fasher, the capital of Darfur, declared himself Sultan. After the fall of the Khalifa he swore allegiance to the British Government, and although he discouraged Europeans from entering his territory, he was virtually given his independence on payment of £500 annually. This state of affairs continued until 1915, when under Turkish influence he threw off his allegiance and threatened the Sudan western provinces. In 1916 an expedition was sent by the Sudan Government, El Fasher was occupied, Ali Dinar fled, and was killed shortly after in a skirmish with the Camel Corps under General Huddleston. The control of the Province then came under the British Administration with Colonel Savile established as Governor at El Fasher. At the request of the Governor of the Chad Territory a British military post was formed at Kereinik on the extreme western frontier, 200 miles from El Fasher, with a company of the 9th Sudanese and two machine-gun sections, and at the end of 1918 I was given command of this post.

On the other side of Wadai strong influences had been at work. In 1873 a formidable revolt led by Suleiman, son of Zubeir Pasha, the great slave-trader at the time detained in Cairo by the Egyptian Government, was suppressed by Gessi Pashi, the Governor-General of the Bahr el Ghazal. Suleiman and eleven of his chief supporters were shot, but one of his most able leaders escaped, a Furian known as Rabeh, who after several years of fighting settled down in Dar Runga on the eastern

frontier of Wadai. In 1891 he failed in an attempt to conquer Wadai, but fought his way across to Bornu, where he defeated the sultans of that country and established a military kingdom with his capital at Dikoa, devastating Bornu. In 1899 Rabeh came in contact with the French under Gentil, and defeated them twice in that year. On 22 April 1900 he again met, and was on this occasion beaten by, the French in a great battle under Major Lamy near Kusser. Both Major Lamy and Rabeh were killed. The French had now started on their invasion of Wadai and the opening of the road across Africa to the Red Sea.

My principal work at Kereinik was the checking of passports of those entering and leaving Darfur, as the French Colonial Government are very particular in keeping a check on the movements of all persons living in or passing through their territory, even of those travelling from one subdivision to another in the administration of the Territoire du Tchad. Many of the passports which came under my supervision were those of pilgrims travelling to and from Nigeria to Mecca, the greater number of whom were very poor people, travelling on foot and often alone, their sole possession an elaborate passport. I talked to many of these Mohammedans, and an interest which I had always felt in the pilgrims to Mecca grew considerably and increased my desire to visit Lake Chad and travel the pilgrim road across Wadai.

Thanks to Colonel Savile, who backed up my application, and to the courtesy of Colonel du Carre, chief of the Territoire du Tchad, and of Colonel Tourenq, Commandant of Wadai, this matter was arranged.

Strangely enough, a few months earlier the same idea had occurred to Mr. Palmer, the British Resident of Bornu, who travelled eastwards on the southern route to Ati across Wadai, and pursued the pilgrim route as far as Jedda. He was, I believe, the first Englishman to cross Africa from east to west through Wadai. The whole journey was made in a dogcart to railhead, this being the first wheeled transport ever seen on the greater part of the journey. The previous year a similar journey was made by Commandant Tilho through northern Wadai, after the completion of his exploration in Tibesti, Borku, and Ennedi, an account of which appeared in the *Journal* of this Society.

The journey which I undertook falls naturally into five divisions. The first, a two days' trek from Kereinik to Adre, passes entirely through the sultanate of Dar Masalite, a little independent state—one of the last independent states in Africa—under the rule of Sultan Mahommed Bahr el Din. I left Kereinik in September 1919 and travelled over country which was flat, with the exception of a ravine encountered shortly after starting, and several large khors which drain into the large Wadi Bari running south. My party consisted of two Hausa boys, five bulls with their drivers, a dozen troopers sent by the Commandant at Adre, with the pack bulls which he had got for me. I reached Drijel in about four hours,

once the capital of the country but now only a small village with the ruins of the old palace of Sultan Abu Beker, whom Ali Dinar of Darfur captured and hanged in El Fasher. He was the father of the present ruler. Though the Masalite were never conquered by the Furians, they withdrew their capital to its present remoter, stronger, and far prettier site at Jenini, 14 miles west on the Wadi Kaja. No doubt the name Jenini, meaning "a garden," is derived from the orchard-like appearance of the country towards the Wadi Kaja.

After leaving Drijel the ground rises for 4 miles to a rocky outcrop, the road passing between high rocky hills giving somewhat the appearance of an immense gateway. From these rocks the land slopes gradually down towards the Wadi Kaja 10 miles to the west, and Jenini on the high ground beyond can be seen. A gigantic plain stretches out, broken only by solitary stony hills, and far to the north the dim outline of the flat-topped hills so common in the western Sudan.

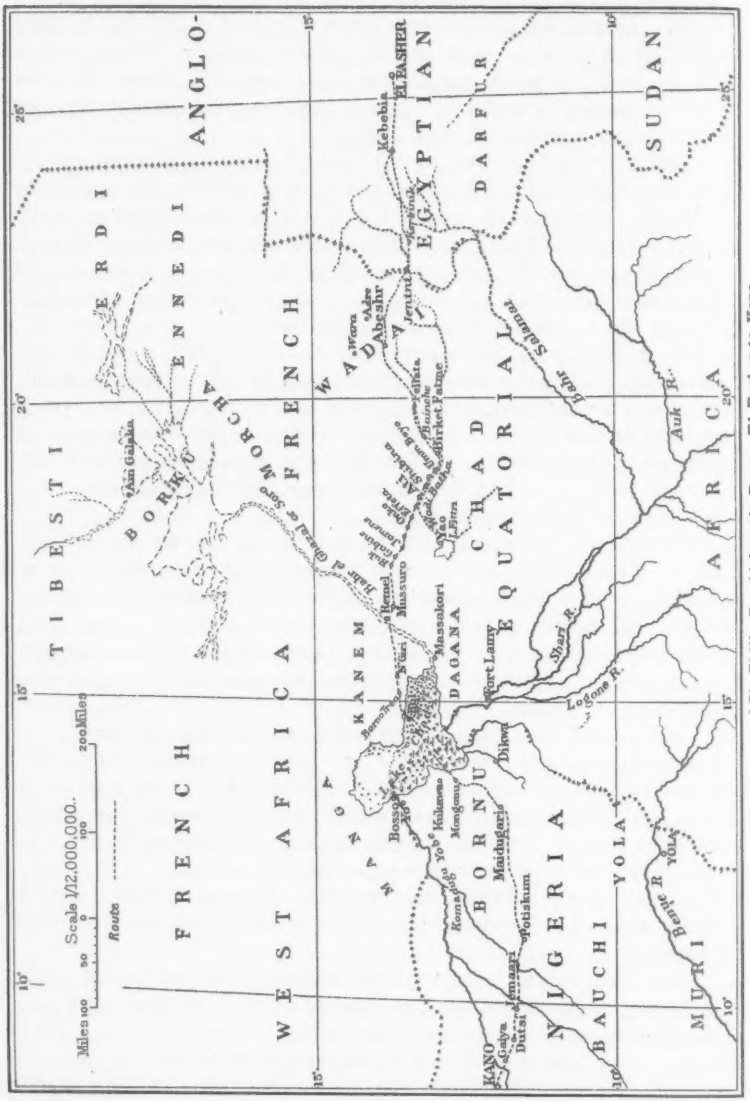
In 1910 a small force under Captain Fiegenschuh had advanced across this plain to the Masalite capital, and the natives, feigning friendship, had treacherously massacred them nearly all. Later the French suffered another loss in Dar Masalite, when Colonel Mole and several Frenchmen were killed. Hadjar Din, Abu Beker's brother who had become Sultan, was deposed, and his nephew Mahommed Bahr el Din was installed by the French.

The town of Jenini, lying under a stony plateau on the western bank of the Wadi, consists of a number of grass-built houses: the palace of mud bricks is a large building surrounded by a network of compounds; it was built for the present ruler by the French at Adre. A very good rest-house, well situated, overlooks the town and surrounding country, together with several groups of houses belonging to the chiefs and relations of the Sultan.

From Jenini the ground rises gradually through a country covered by thorn scrub, rocky and uncultivated for 8 miles. A crest is then reached from which the country slopes down towards the Wadi Azunga on which Adre is situated. Twelve miles further on Adre can be seen clearly from this high ground. After leaving the ridge I noticed clay, whilst the rocks at a little distance away had the appearance of sandstone. The country itself was rapidly becoming more wooded. Between Jenini and Adre there appeared to be very little habitation and I only saw two small villages.

The Wadi Azunga is the boundary between Wadai and Dar Masalite, and though it is narrow, the Commandant of Adre told me that during the rains the water runs swift and deep, and is at times practically unfordable. The French on their side of the Wadi have cut an excellent road through the bush, and an hour's ride along it brought me into Adre, a well laid out and substantially built fort. Beyond and below this, for some time after the rains, is a large lake about a kilometre in length and 250

metres wide, on which are a considerable number of wildfowl. All the buildings in the fort are of sun-dried mud brick, the large buildings flat



Sketch-map of Sir Philip Brocklehurst's Route, El Fasher to Kano.

roofed. The barracks are of rows of mud brick tukles or native huts with thatched roofs, the soldiers, who are chiefly Senegalese, each having a

tukle. The French have a poor opinion of the fighting powers of the local element. All the soldiers are taught French, and all orders are given in that language. The French officers spoke no Arabic and the interpretation was done by a Senegalese corporal. The soldiers keep their ammunition and settle their quarrels outside the fort. Should one be killed, the survivor is sent to Fort Lamy for trial.

I obtained fresh transport bulls at Adre. The road to Abeshr runs for the most part through thick bush-covered flat country, broken here and there by small stony hills, frequent khors, and an occasional wadi, or very large khor. The natives did not appear to be numerous, and their villages, usually quite small, twenty or thirty huts in all, for the most part were at some little distance from the road and hidden by the bush. There were patches of cultivation along the road on either side of the villages. Game was very scarce; an occasional gazelle or dik-dik crossed the road, but there was no spoor of larger game, though tiang were quite common in the neighbourhood of Adre. As for birds, ground hornbill, greater bustard, and lesser hornbill were numerous, and in the vicinity of Birdba a grey stork with a bright red patch on the nape of its neck and red marking on the head was very common. In one small area I counted over two hundred of these large birds of every shade of grey.

On the fifth day I crossed a very large wadi which the soldiers informed me was the boundary between the divisions of Abeshr and Adre. This country would afford very little chance for an aeroplane making a landing, though the ground is very level. From the ridges one looks over a green sea of scrub, with little stony hills dotted about like islands.

The day before reaching Abeshr I crossed a strange rock wall 10 to 15 feet high and a few feet thick of granite boulders, running due north and south as far as I could see, like an old Roman wall. Later the road passed through a basin of rocky hills.

The morning of the eighth day saw me within a few miles of Abeshr. I had been looking out anxiously for the mountains surrounding the town, which the travellers through Kereinik had often referred to, but it was not until I was comparatively near that, on topping a rise, I saw the great amphitheatre of hills with Abeshr lying in the centre of the basin. As I approached the town the large mud-brick buildings with flat battlemented roofs and well-built market square gave it a look of importance and solidity, though it did not appear to cover a great area. Indeed it had more the look of a town than any I had seen since leaving Khartoum. This was probably due to the absence of grass-built tukles. I was met by Colonel Tourenq and his staff, and was conducted to the old walled square of the palace of the Sultans of Wadai, where now are the Commandant's house, offices, wireless station, and some soldiers' quarters. The wall surrounding the square is of solid structure over 15 feet high and 6 feet thick—a fort in itself.

During my stay in Abeshr I received the greatest kindness and

hospitality from the Commandant and his staff. Colonel Tourenq told me that they had great difficulty in obtaining stores, such as sugar and tea, and they were chiefly dependent upon the Greek and Syrian merchants trading between Khartoum and Abeshr, and their charges were exorbitant. I think sugar was twenty-five times its original cost in Khartoum. They asked me anxiously how the railway was progressing between El Obeid and El Fasher, and were astonished when I sadly told them there were not even signs of a beginning, and that its route had not been definitely decided. They were under the impression that it would soon be at Fasher, and perhaps some day continued to Nigeria through Wadai. I might remark here that except for the mountains in the neighbourhood of Kebkebia there appeared to be no difficulties in the way of laying a line from El Fasher as far as Ati, where I left the main route. Labour is easily obtained, water could be plentifully stored in large tanks during the wet season to afford an ample supply during the dry season, and timber can be found at places of no great distance apart.

Abeshr became the capital of Wadi in 1850, 25 miles south of the old capital at Wara, where the state of Wadai was founded in 1640 by Abd el Karim. The town was built by the Sultan Sherif, who was succeeded by Ali whom Nachtigal visited in 1873.

In 1909 the French occupied Abeshr with very little resistance, and from that time ceased the great slave trade of which that city had been the centre for many years. The two main slave-routes were Abeshr–Kufara Oasis–Tripoli and Abeshr–Darfur–Kordofan to the Nile. The loss of life amongst the slaves on these two terrible roads was estimated at seventy-five per cent.

The population of Abeshr, now from four to five thousand, has decreased considerably since the French occupation, and many of the old houses and walls, no longer cared for, are crumbling away and gave me the impression of Pompeii on a small scale. The water supply is from wells. The dress worn by the men throughout the country is a long white jebba or shirt and a pair of very baggy trousers of cotton home-spun, coarse but strong. The women usually wear the blue or coloured tobe, like that worn by the Sudanese women; the material they buy from the Greek and Syrian merchants. Of two long pieces of cotton material, one is wrapped round to form a tight skirt, and the tobe is thrown over the head and shoulders. The young girls do not wear the becoming rahid or leather-fringed kilt worn in Darfur. Heavy silver bangles round the ankles and silver and copper rings are most popular ornaments, with a thin gold imitation Austrian dollar sold by the merchants for £3 each, and suspended from the neck. The chief trade in and around Abeshr is in cattle, sheep, and goats, hides and Morocco leather goods, such as shoes, purses, and leather bags, and vegetables. French money is used throughout Wadai, and though the metal coin is preferred the paper money is accepted.

At Abeshr I got a fresh lot of bulls and horses and proceeded to Umm Hager—75 miles. I had been travelling one shid or period of travel a day, and now decided to increase the speed to double shids, morning and evening. Once out of the amphitheatre the country resumed its flatness, though less scrub-covered and much more park-like. Large herds of Heuglins and Korin gazelle and Corrigum tiang were everywhere. Some of the soldiers tried their skill with their rifles, but the state of the sights on their carbines, damaged or missing, gave me little anxiety on account of the tiang. Frequently the road crossed large areas of cotton soil, black and flat as a table. I met a few natives with bulls, but until now I had seen practically no travellers; the rains were barely over, so the general traffic had not begun. White cranes were to be seen everywhere, and a palm-bush vegetable ivory began to make its appearance; water-melons were very plentiful. Halfway to Umm Hager the bush becomes very thick again, and the road is cut absolutely straight for longer than a day's hard march, which was very monotonous. Little or no life was to be seen in this thorn-bush country, though occasionally a jackal crossed the road.

The road struck me as very suitable for Cape waggons with good spans of oxen. Bulls are the chief transport animals; the road is level and the sand not particularly deep. As we approached the Wadi Batha on which Umm Hager is situated the dom palm with its cluster of hard nuts about the size and colour of a large golden plum became very common. These nuts are harder than wood, and when scraped smell like gingerbread. In the Congo and amongst tribes who work ivory tusks into figures and weapon hilts, the nut is used to polish the ivory.

On arriving at the Wadi Batha I found it still contained large sheets of water, and on the far bank the fort of Umm Hager looked most imposing. The two-storied buildings were enclosed by a high wall and, as in the other forts I had visited, avenues of trees had been planted and an excellent kitchen garden was under cultivation. I saw some horns of the *Oryx leucoryx* in the fort, and the Commandant told me they were common in the district. Here, as in Abeshr and Adre, in a remote part of Africa, were two-storied houses with doors, sunblinds, and staircases.

As I left the fort of Umm Hager and passed the town, I met a little further along the road a large caravan of Hausa pilgrims and travellers from Bornu, their worldly goods tied on bulls, with the women and children perched on the top. I was now heading for Ati, 110 miles ahead, where the road divided, and where I should leave the main Fort Lamy road and travel north-west to Mussuro. The country still remained level, covered with acacia and dom palms. There was here no sign of game, but a large black-and-white crane had put in an appearance, and greater bustard were common. The cultivation, of which there was much, was dukan, a small millet, not dura, the larger millet, which is grown further east.

At Birket Fatme I met another large body of poor Hausa people

travelling to Kereinik and onward, mostly tramping along with all their possessions on their backs, and the elaborate passport. Here, as all along the route, I was struck by the excellence of the rest-houses, and the promptness with which the people of the neighbouring village appeared with water, eggs, milk, and grain, and seemed quite surprised at receiving payment.

The road ran over black cotton soil, with quantities of wild cotton for great distances, and frequently long channels of water were cut in the road, about 20 to 30 feet wide as a rule and several feet deep. I met natives carrying long round-bodied fish which they called "hud" and sold to my men. I did not taste one. They told me they caught them in the mud of the Wadi some distance below the surface.

Hundreds of white cranes with black wings were everywhere to be seen until I reached Umm Boyo, after which they disappeared, their place being taken by perfectly black cranes, and before I had covered 24 kilometres they too had gone, and the crested crane was everywhere. The greater bustard and lesser hornbill and flocks of guinea fowl were still common. As I approached a large deep but dry wadi troops of baboons crossed and re-crossed the road.

From Dogochi to Shibina I passed over some very large open spaces of hard level cotton soil. Here was the first place I had seen since leaving Abeshr where an aeroplane could make a safe landing on unprepared land. Within 15 miles of Ati was forest country with trees of considerable size, but as I drew nearer to Ati the country opened out again to yellow grass-covered plains, and the cultivation of dukan increased, which appears to be the staple crop.

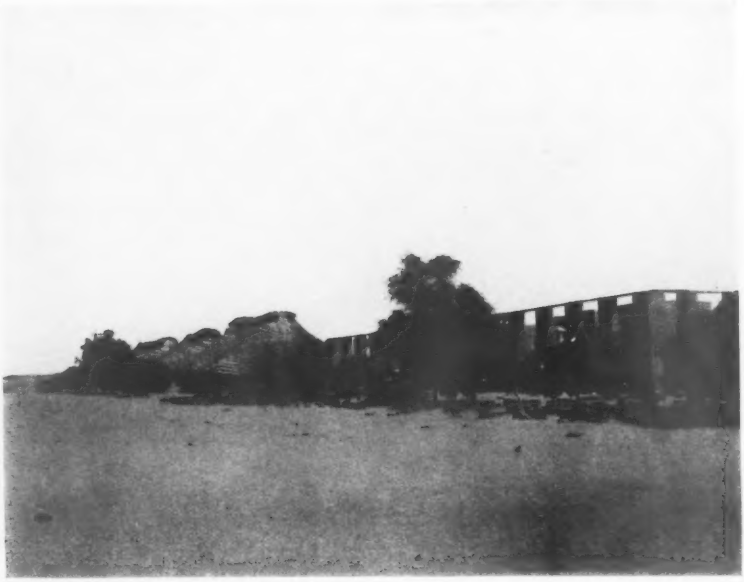
Ati itself is an enormous grass town laid out in squares, the biggest grass town I have seen, and it appeared to be peopled from every tribe in North Africa. The fort was 400 yards beyond the town, a large walled village containing red brick buildings of considerable size. Between the fort and the town there is a wireless station in communication with Lyons. Beside the wireless station there is a brick-built market, cloth-making school with the native looms weaving the local cotton homespun from wild cotton, and French language school; and on the banks of the Wadi, a quarter of a mile away, an immense kitchen garden wonderfully laid out and cultivated, a brick furnace, and dairy farm.

The natives of the Ati division or district are Bulala, heavily built pug-faced people. They have a Sultan at Yao, but the French have deprived him of all his power. On October 10 I left for Mussuro, 138 miles further on through the same flat acacia-covered country, though gradually rising. Gazelle and tiang were much more numerous. After 30 miles I reached a crest from which the country stretched out as far as the eye could see, north, south, and west. This must be the watershed which drains west and south to lake Fittri and the Bahr el Ghazal respectively.

After another 20 miles the country changed rapidly, the land becoming

ABESHR

UMM HAGER



ATI

BULL TRANSPORT IN WADAI

MUSSURO

KANEMBU VILLAGE

NGURI FORT

RAFT ON LAKE CHAD

much more undulating. The cotton soil gave place to sand, except in what appeared to be old lake-beds, which were probably swamps during the rains. The deep sand made the going terribly heavy, and the country became broken up with large deep valleys with dom palms growing along the sides and dark grey soil in the bottom. These valleys ran north and south with an easterly trend, and the road twisted about along the sides. There were no signs of cultivation or habitation. Four hours of this heavy going brought me to Huk, where there was a solitary rest-house built from the black timber of the dom palms. For miles and miles the track ran over deep sandy plains covered with a tall sweet-smelling yellow grass. I knew the scent of this aromatic grass well, but I had never seen it growing in such profusion before. Here and there an isolated group of dom palms broke the yellow horizon.

After leaving Huk the country changed completely, and the sand steppes gave place to a park-like country studded with large trees; though a few hours later it opened out with the old grass-covered sandy plains of the previous days. I was met 8 miles from Mussuro by Capt. Coronado and Lieut. Pasquet, who suggested we should gallop back to Mussuro; but I assured them my horses were tired, so they insisted on changing my saddle to a chestnut horse ridden by the corporal; and leaving the troop to follow with my bulls and horses, we set off at a gallop which we kept up most of the way to Mussuro. The horses were pulling hard at the end of 8 miles in spite of the heavy going in places, which astonished me, as they had come to meet me at a similar pace. The French officers told me they always travelled at that speed, and all the horses in the fort looked wonderfully fat and fit.

Mussuro is the headquarters of the French Colonial cavalry of the Territoire du Tchad, and all the cavalry are there except for one troop at Gog Bayada; a squadron consisted of about 72 troopers. The grey mud fort with its well-built flat-roofed houses, horse lines, and barracks, stood on rising ground overlooking rolling park-like country. The village, inhabited by a mixed crowd of half-breeds, stood at a distance of about a quarter of a mile across a valley.

The natives of the country are Gouran Arabs and live a wandering life in tents. With their flocks and herds of cattle and horses they are immensely rich in kind. The region is well watered by wells and eminently fit for cattle-raising. They are Arabs and lighter built than the Kwalmi of Wadai and Bulala of the lake Fittri country. These Gouran live in camps called Feriks, which move about the country according to the condition of the water-holes, and as I travelled from Mussuro to N'Guri across a roadless country I had to move from one Ferik to another. At one of these camps I noticed a bull dressed up in the beautiful cowrie-shell covered leather trappings, and a woman in a kind of howdah on his back. The Kababish Arabs, I believe, dress their camels in the same kind of trappings. I noticed all these Arabs

rode mares, which is seldom done in the countries I had come through. The grass of this country makes excellent hay, and some 60 tons I saw in Mussuro smelt and looked like good meadow hay.

Three days took me to N'Guri in the province of Kanem. The fort, a group of dazzling white buildings, is surrounded by an equally dazzling wall on the top of a barren sandhill. A quarter of a mile away was a deep little valley, dark and cool, with its heavy green vegetation and big trees, the water just below the surface. Here the fort garden flourished and grew pawpaw, bananas, limes, melons, and vegetables.

Numerous are these steep narrow little valleys, almost long narrow holes, full of tropical vegetation, rich soil, and plentiful water. One comes on them very suddenly, and in the early morning one descends their steep banks into a cold damp atmosphere and up again into the warm air all in a few minutes. They are very strange features in this parched and practically rainless desert country. The Kanembu natives cultivate them extensively, and many of these valleys have all the appearances of a garden. Irrigation on a small scale is carried out by small channels from the wells, which are worked by means of the hide bucket and long pole as seen on the Nile.

N'Guri fort was under a French sergeant and is included in one of the subdivisions of Mao. From N'Guri I rode to Diguedada, 16 miles distant, a large Kanembu village which was under a sheikha or female chief. She was quite light-coloured, as were many of the women, though the men were black and distinctly Kanembu, a heavy stupid-looking race, and from what the sergeant at N'Guri told me, no less stupid than they looked. Their huts were thatched from the ground and had the appearance of huge beehives. Ostriches were common in these parts, and most of the houses had one or more ostrich eggs stuck on the top. A few Dorcas gazelle, greater bustard, ostriches, flocks of guinea fowl and red monkeys were all the animal and bird life I saw.

On the morning of the second day I began to get in touch with lake Chad. Crossing several large lake-beds now dry, by mid-day I reached the long arms of the lake which stretch out on its western side for several miles; these were full of water, but I was told in a month or two would be quite dry, though they looked very substantial sheets of water. Between these numerous arms of the lake the country is covered with high sand dunes and quite unlike the flat shores on the western side.

The sergeant in charge of the fort at Bol came out to meet me, and as we rode into the station the local band, consisting of two drums and a pipe, followed us. The piper blew so hard and his cheeks became so distended that they appeared white; I expected them to burst, and was quite relieved when the fort was reached and the band dispersed. We dined at once, and I put on all the clothes I could to try and defeat the armies of mosquitoes; but all to no avail; the whole place is alive with them as soon as the sun has set.

The following day I inspected my two rafts. These cigar-shaped boats are made from bundles of papyrus reeds tied together and all lashed in the shape of a cigar. They last for about a couple of months, when they become water-logged. One raft carried my horse, and the other myself and baggage. It was fitted with an awning and matting shelter, its length being about 18 feet and 6 feet wide.

The village of Bol was a dilapidated place inhabited chiefly by people crossing backward and forward from Bornu with trade goods, and the sergeant told me his chief work was to stop smuggling. The natives brought in a quantity of cotton evidently grown locally.

I left on October 26 with four Buduma natives to pole each raft, a most pleasant way of progressing after the long hot rides I had been accustomed to do, sometimes 40 miles in a day. The poles used to propel these rafts were 12 feet long and made of wood lighter than cork, but strong, called ambatch.

The Buduma live on the islands on the lake; they are seldom found on the mainland except when they land to sell their fish. Tall powerful men, with not unpleasant features, they are wonderful swimmers and practically live in the water.

We passed many islands, some of considerable size, though at times the lake opened out into large expanses of open water. The greatest depth I found was 4 metres, but the sergeant at Bol told me in places the lake reached a depth of 14 metres after the rains.

But my paper is limited to Wadai, and much has already been written about lake Chad. The four days I spent in crossing its waters were interesting to me, but I can add nothing to the information already published about this lake. I was particularly interested in a large black otter which is fairly numerous and has a beautiful pelt.

In conclusion, I should like to say that throughout the whole of my journey I was received by the French officers at every post with the greatest kindness, hospitality, and friendship: everything possible was done to assist me. They pressed me to stay as long as I liked, and had I not been firm I believe I should still be there, and when I left the best transport bulls were found at once. On several occasions they insisted on lending me their private horses to save my own, and would not hear of my travelling without an escort of mounted soldiers; I could not have been treated better had I been a fellow-countryman and personal friend of each commandant I visited.

Before the paper the PRESIDENT said: I have much pleasure in introducing to you Sir Philip Brocklehurst, who, as you probably know, accompanied Sir Ernest Shackleton on his first expedition to the Antarctic in the year 1907. Sir Philip has the distinction of having come of age on the summit of Mount Erebus, 14,000 feet above sea. Some months ago he came to the Society to have a talk with us about this paper, and as soon as he had left the room I remarked that he would be just the man for the Mount Everest

expedition. But unfortunately he had suffered from frostbite, and so, much to our regret, he is not available for Mount Everest. I have much pleasure in asking him to give us his paper.

Sir Philip Brocklehurst then read the paper printed above, and a discussion followed.

Sir ALFRED SHARPE: I am sure we must have all listened with great interest to the paper which has been read to us this evening by Sir Philip Brocklehurst. I have not been in Wadai myself, but Africa is Africa, and having been over some parts of it one feels in touch with a man who has been in other parts. It struck me that the lecturer entitles his paper "Across Wadai," but his journey was across Africa, from the Red Sea to the West Coast, where he came out at Lagos. I think he has been very modest in not telling us that, as a very few years ago a through journey from east to west would have been looked upon as something remarkable. All his route was through dry Africa—Mohammedan Africa—the Africa where you have horses, and where you do not get much rain or tsetse fly. He told us how the French always teach French to natives in the African countries they administer, and I have often thought we fail in that respect. We make our officials learn the native languages, but take no steps for the teaching of English. After all, English is a fairly universal language. From the appearance of this country, right across from the Nile to the east side of Chad it is evident that it is easy country for railway construction. I do not know whether a railway there would pay as yet, but it does seem that wherever a railway is laid in Africa it pays in the end. I can fully confirm what the lecturer said of French hospitality. Their officials are the most hospitable people you could meet in Africa. In French Guinea I was received in just the same way. I am sure you will join with me in thanking Sir Philip Brocklehurst for a most interesting paper.

The PRESIDENT: What very much impressed me this evening was the account Sir Philip Brocklehurst gave of a pilgrim route leading right across Africa to Mecca. Far away in Central Asia, many hundreds of miles the other side of the Himalayas, up in Chinese Turkestan, I used to see villagers preparing for this great pilgrimage to Mecca, though it would take them the length of Chinese Turkestan and then something like 600 miles across the Himalayas, right down through India, across the Indian ocean. And here we have the lecturer this evening telling us of Negro people from the West and Central Africa, travelling likewise across great deserts to reach the same goal. What is equally remarkable is that in all these parts of the world whence pilgrims gather everywhere British travellers are found.

A point that strikes British travellers, and especially those who have been engaged in administration, on coming into French territory, is to find that the French do not learn the language in the same way as British officers are made to do (whether they like it or not). The French, on the contrary, make their soldiers or the people of the country learn French. I think Sir Alfred Sharpe has hit the nail on the head, and has given us the best solution, that, while we should learn the language of the people of the country we are administering, we should also make the people and soldiers learn our language. I think that we ought to bear this in mind. From the photographs we have been shown we have seen how flat the country is, an almost continuous plain. And one would have imagined this a very fit country for the use of aeroplanes in reconnaissance and travel. So it was rather disconcerting to hear that in most of this country

it would be impossible for aeroplanes to land without prepared landing-places. Sir Philip Brocklehurst spoke a great deal about the gardens, but I must say that when he put the gardens on the screen, it was just as well we had him here to tell us they were gardens. I know you will join with Sir Alfred Sharpe in tendering your thanks to Sir Philip Brocklehurst for his most interesting lecture. We congratulate him on his journey and we should like again to recognize the very great hospitality which traveller after traveller tells us of receiving from French officers in every part of Africa.

ARCHÆOLOGY AND THE ORDNANCE SURVEY

O. G. S. Crawford

Read at the Afternoon Meeting of the Society, 16 *January* 1922.

SIXTEEN years ago a paper was read before this Society by the late Prof. Haverfield on "The Ordnance Survey Maps from the point of view of the Antiquities shewn on them" (printed in the *Geographical Journal* for February 1906). It is an honour to be associated in any way with the work of that great archæologist; and it is pleasing to think that some of his suggestions are now being put into practice. Prof. Haverfield dealt, as usual, both critically and constructively with his subject. I do not intend to go again over the ground he covered, but to give a brief outline of the methods employed at the Ordnance Survey for dealing with antiquities.

Antiquities were marked on the earliest edition of the 1-inch map begun in 1797.* This map was for military purposes, and the whole energies of the Survey were concentrated on it until 1824. By this time the whole of the south of England and part of Wales had been surveyed in the field, and many engraved sheets published. In 1824 the Survey of Ireland on the 6-inch scale was begun, and the work of the 1-inch map was almost entirely suspended. During this period of twenty-seven years —roughly the first quarter of the nineteenth century—a large quantity of archæological information was collected and recorded on the hand-drawn originals, which were on a scale of 2 inches to the mile. Some of this information was lost when the authorization for the large-scale survey was made in 1855, at which date the whole of the 1-inch maps extending over some sixty or seventy years were "put aside." (Report of Departmental Committee, 1893, p. vii.) Antiquities which had disappeared, or become partly effaced, between 1824 and 1855 were not recorded on the new large-scale survey, even though they had in many instances been marked on the 1-inch map. This break in continuity was unfortunate, but is not irremediable. The sites have been recorded with considerable accuracy

* Although this was the date when the 1-inch map was begun, General Roy, when a lieutenant, made several route-traverses along the roads leading from London to the coast. Some of these, on a scale of 1 inch to the mile, are in the British Museum (Manuscript Department).

on the old MS. 2-inch sheets, and it is generally possible to re-discover the remains of the barrow or other earthwork on visiting the site to-day. When this can be done the antiquity in question can of course be replaced on the Ordnance Map. The loss incurred by this break was, however, counterbalanced by an enormous gain, both in numbers and accuracy, in the record of antiquities on the large-scale maps.

The original 2-inch MS. maps drawn during the first quarter of the nineteenth century are preserved at the Ordnance Survey Office. They contain a certain amount of information that was omitted in the engraved published 1-inch maps. I have alluded elsewhere to an instance of these omissions ('Man and His Past,' pp. 170, 171) some of which are of the greatest archæological value. On the other hand, the engraved 1-inch maps contain some archæological information which does not appear on the 2-inch MS. originals. How these additions came to be incorporated I do not know. Perhaps it was during the final checking done in the field. Some of these additions also are of the greatest value, because the objects so recorded were destroyed before the large-scale survey was begun. I came across an instance in Brecknockshire last summer, where a chambered Long Barrow called "Croesllechau" (the Cross Stones) was marked on the engraved map of 1832, but not on the MS. 2-inch map of 1814, nor on the later 6-inch map. It has now completely vanished, and there is no other record of its site.

There is little direct evidence of the methods employed in the field for recording antiquities. The Departmental Committee's Report of 1893 does not once mention the subject in all its 350,000 words. But there can be little doubt that the practice of a few years ago was substantially the same as in the early part of the nineteenth century. This was to make local inquiries about antiquities and to insert those which were well authenticated—that is to say, those vouched for by residents or described in print. Whether this practice produced good or bad results in different regions depended entirely, of course, upon the qualifications of the residents whose advice was asked. In Wiltshire the Survey consulted Sir Richard Colt Hoare with excellent results. I had long known that this must have been so, but had no proof until the other day, when I came upon a copy of the engraved 1-inch map of 1817 (Sheet fourteen of the original large-sheet series) corrected in Sir Richard's own handwriting. The archæological excellence of that map is undoubtedly due to him, since there was no other man then living who could have supplied much of the information embodied in it. Incidentally it may be noted that the Survey must have obtained from him their barrow-symbols, which are the same as he used on his 1-inch maps—a circle for round barrows and an oval or pear-shaped symbol for long barrows. It is most fortunate that he should have induced them to indicate this distinction graphically, and it has led to the re-discovery of several Long Barrows which might otherwise have now been regarded as of uncertain character. In his day, of course, there

was a far larger amount of virgin downland, and many barrows and earthworks which are now under plough were still intact and more easily recognized than they are now.

I should prefer to say nothing about the archæological mistakes on the Ordnance Maps, because it is agreed by all that such exist, and steps are now being taken to eliminate them as quickly and thoroughly as possible. But a few words must be said to indicate the ways in which it is purposed to accomplish this. Prof. Haverfield classified the errors into four groups, giving instances of each.

1. "Archæological remains now visible on the surface are surveyed without archæological experience." That is, of course, inevitable, as Prof. Haverfield admitted. Only such experience can enable one to recognize an ancient earthwork, or to select for insertion on the map those portions of it which are ancient and relevant. It is particularly difficult, even for an expert, where the ground has been disturbed in later times. Improvement is possible in two ways. If some archæologist has already surveyed the district, the Ordnance surveyors can be referred to his published plans and description. Mr. Heywood Sumner's work is an example of the kind of survey I have in mind; it is a model of how such work should be done; and it will be invaluable when Hants and Dorset come to be revised.* So too will Dr. Williams-Freeman's 'Field Archæology as illustrated by Hampshire' (Macmillan, 1915). Deficiencies of this kind will have been noted on the 6-inch map of the Honorary Correspondents to the Ordnance Survey; and others the Archæology Officer himself will be able to correct when going over the ground immediately before revision. In the last two instances marginal notes should suffice to elucidate the corrections indicated graphically on the map itself.

2. "Local information is not always adequately sifted." This source of error can in future be almost entirely eliminated. When the Ordnance Survey deals directly with individuals, *i.e.* with its Honorary Correspondents, care will have been taken already to appoint only reliable people. Even so, the information they supply will be sifted at headquarters and only certainties will be allowed to pass. When it deals with Societies which have made themselves responsible for their area, there will be a double sifting, first by the Secretary or other officer of the Society, and then at the Ordnance Survey Office.

3. "Literary or printed evidence is admitted without being tested, sometimes in the shape of incorrect titles or descriptions, or sometimes in the shape of measurements transferred bodily from book to map." Needless to say, the evidence of written authorities will be very

* 'Earthworks of Cranborne Chase,' 1913; 'Earthworks of the New Forest,' 1917, and "Ancient Earthworks in the Bournemouth District," 1921. The first two are published by the Chiswick Press, the third in the twelfth volume of the *Proceedings of the Bournemouth Natural Science Society*.

severely tested, and past errors due to this cause will as far as possible be corrected.

Under this heading come a large number of Roman names which are pure inventions. They are nearly all derived from two sources: the so-called 'Itinerary of Richard of Cirencester' which was a forgery compiled by Bertram in the first half of the eighteenth century; and the writings of Camden, Stukeley, and a few other authors. Stukeley invented many names deliberately, and said so when he first put them in writing. Neither he nor his readers for a moment supposed that these names were the original names used by the Romans. But they were adopted for convenience; and eventually thus got on to the Ordnance Maps. It is natural that people should think (as most of us did once) that a Latin name such as *Via Devana* was the one which the Romans gave to the Roman road in question. But it is not; it is only what Stukeley called it. We do not know the Roman names of any Roman roads in this country; names like Watling Street, Fosse Way, Ermine Street and Icknield Way are none of them older than the Saxon Conquest.

4. "The symbols for marking remains are somewhat imperfect, especially in two respects—in the signs used to distinguish ditch and mound, and in those used for remains which are visible as contrasted with those which have vanished from the surface." I think Prof. Haverfield overestimated the imperfection of the hachures; at any rate I have not found them so difficult to read in the South of England. Both the points in question, however, are technical ones which should present little difficulty when attention has been drawn to them.

I will now describe the system at present operating. For the benefit of archæologists not familiar with Ordnance Survey procedure, a few explanations are necessary.

Alterations and additions can only be made to the large-scale maps, with which alone we shall be concerned, during revision, when each sheet is revised on the ground and re-drawn. These sheets are, of course, on the scale of 25 inches and 6 inches to 1 mile. Revision takes place by counties and is always in progress. At the present moment the counties of Forfar, Northumberland, part of the West Riding of Yorkshire (round Sheffield), Staffordshire, Hertfordshire, and Wilts are being revised. Naturally the antiquities of these counties will be dealt with before those of others not due for revision until later. Special attention is being given to the antiquities of the counties of Wilts, Herts, and Forfar. It takes a year or two to revise a county in the field; and with the exception of those counties whose population falls below one hundred inhabitants per square mile, each county is revised once every twenty years. The others are revised every forty years only. In England the only forty-year county is Westmoreland; in Wales Merioneth, Montgomery, Cardigan, Radnor, and Brecknock are only to be revised once in forty years; in Scotland Caithness, Sutherland, Ross and Cromarty, Argyll, Inverness, Nairn,

Elgin, Banff, Perth, Wigtown, Kircudbright, Dumfries, Roxburgh, Selkirk, Peebles, and Berwick.

Now the chief difficulty of the Ordnance Survey in its work of recording archæological sites is, How far can the local archæologist be trusted? There is a kind of dilemma in all such matters; the local archæologist knows where the site is; he knows, for instance, the site of a barrow or of a Roman villa not previously recorded; but he may not have the necessary experience to recognize its real character. The expert, on the other hand, who has the experience, cannot be expected to have the local knowledge. Nine discoveries out of ten are made by local men; the problem is, how to secure that these discoveries are placed on record in such a way that they can be visited and diagnosed, so to speak, by an expert, when an opportunity occurs. The appointment of an Archæology Officer at the Ordnance Survey will go a long way towards solving this problem. His principal duty is to see that the archæological entries on the Ordnance Survey Maps are as correct and as complete as possible. He must get in touch with local archæologists all over the country, especially in counties likely to be revised in the near future, and must help them to help the Ordnance Survey. He must also, in the interests of accuracy, constitute himself a severe critic of their work—a very necessary but very thankless task.

The method which has been adopted is to supply societies, museums, or individuals with sets of 6-inch maps of their county or district, and to appoint Honorary Correspondents of the Ordnance Survey in archæological matters. Their business is to mark on the maps the sites of any antiquities which are omitted, and to correct any errors of description they may find. (The former is the more important; the latter can generally be done better at Southampton.) A set of notes has been printed for their guidance, with a specimen field sheet—the 6-inch map of Marlborough.* These notes contain, amongst other things, the terminology which will be adopted in future to describe antiquities. I will not however weary you with matters of detail. Let it suffice that this system of voluntary co-operation is working very well. Most of the south of England has been already allocated; and Wales is gradually being dealt with by Mr. Ward and his successor at the National Museum of Wales, Dr. Wheeler. At the last Congress of Archæological Societies we had an exhibition of 6-inch maps to show the progress already made.

Now it must not be supposed that this Archæological Survey of the country which is going on, lightens the labours of the Archæology Officer. It has just the opposite effect; it increases them. It results, for one thing, in a large and growing correspondence, larger probably than the correspondents realize. It means that when a county is being revised, correspondents' maps are called in temporarily; and the information added

* The "Notes" are on sale at the Ordnance Survey, price 4*d.*; also the map, price 1*s.* 6*d.*

in manuscript has then to be sifted and the selected entries copied on to another set of maps. All entries are also copied on to a third set—the record set of the Archæology Officer, who, whenever possible, investigates doubtful entries in the field himself. If he cannot do this, the doubtful entries are of course not incorporated.

It should hardly be necessary to explain the importance of having the country surveyed from an archæological point of view; but since archæologists, at any rate in the past, have often failed accurately to record the *positions* of their discoveries, a few words on this seem needed. In the first place, what is meant by an accurate record of position? I take it to mean a record sufficient to enable future generations to discover the actual spot on the ground, even supposing all existing landmarks to have vanished. Such a record can only be made in this country by marking the spot upon one of the large-scale Ordnance Survey maps. A supplementary question arising out of this is, what in archæological field-work constitutes a new discovery? Without hair-splitting, it may be said, I think, that there are two orders: (1) entirely fresh discoveries previously unknown to science; and (2) the discovery of the site of an object already known to exist, but whose exact position has not been accurately recorded, though it may be known to within anything between, say 50 yards and a mile.

Accurate record of position is of course important for its own sake, quite irrespective of any particular ulterior object. It has also a practical importance. All sites of importance should be accessible to students, and especially classical sites which have helped to "make history" and which are described and figured in all the text-books. Only by visiting, at any rate, some of these sites he reads about can the student ever get to know his subject. Incredible as it may seem, many classical instances of Long Barrows—our oldest national monuments—were not recorded on the Ordnance Maps until last year. Several of those excavated by Canon Greenwell were recorded only by the name of the field in which they stood, and by a distance and compass bearing from the nearest village. One of them, the Avening Barrow, figured in Thurnam's classical article, had been completely lost, and was rediscovered in two places—the barrow was found in its original position and the burial-chamber in the rector's garden! It is only fair to add that the stones were removed there over a hundred years ago, and had they not been they would undoubtedly have been destroyed.

Another reason for accurate record of position is concerned with preservation. The Inspector of Ancient Monuments has very full powers now, but he is hampered in exercising them if he be not in possession of equally full information. In obtaining this, I think I may say he can count upon the assistance of the Ordnance Survey and its correspondents, whose maps will before long contain a very complete record of ancient monuments, particularly of those belonging to prehistoric

times. In exchange perhaps I might suggest that the Inspector of Ancient Monuments would ask his correspondents to enter on their maps information which the Ordnance Survey would value, but which is not probably of much use to him—for example, sites where ancient remains have been discovered, or where they formerly existed, but have now vanished.

While on the subject of the accurate record of position, I wish to call attention to a distinction frequently ignored. It is between the record of a site and its description on the map. The site itself becomes a scientific fact as soon as its position is accurately recorded on the Ordnance Map. The description then given to it on the map may be correct or not; but if the description is wrong it can easily be changed by a stroke of the pen. If, however, the site has *not* been recorded on the Ordnance Map and the monument itself is not now in existence, the site cannot be recorded; it is gone beyond recall. There are, of course, laborious ways of recovering the site, such as, for instance, by means of old private maps and excavation; but these may be unsuccessful, and naturally they cannot be used by field-workers as such; the latter must at any rate be left to future generations. Obviously it is better to record a site accurately and give it a wrong name than to leave it unrecorded. There is, however, no reason why it should be given a wrong name. The new system of nomenclature—which does not differ very greatly from the old—aims at descriptions which are descriptions only and not inferences. (No one, for instance, would question the propriety of using such non-committal words as "tumulus" and "Long Barrow" to describe certain kinds of earthen mounds.) But if future generations wish to make a change of nomenclature they can do so. It is entirely otherwise with the site itself. Archæologists a few years or a century hence will not be able to insert at will the sites of antiquities which no longer exist or of discoveries of which no record was made on the map. Many sites of both these kinds exist now and are known only to a few individuals, often only to a single individual. When he dies his knowledge will die with him, and important scientific evidence will be lost for ever. Much has already been irretrievably lost in this way through the carelessness of archæologists in the nineteenth century. It is hoped that, through a combination of indoor and outdoor work, something may yet be saved from the wreck of the past before it becomes too late; and that future discoveries will be recorded at the time they occur on the 6-inch maps supplied to archæologists for that purpose by the Director-General. If we get this done now we shall in, say, twenty years' time have a valuable, and by then I hope fairly complete, large-scale survey of our national antiquities; if we do not, we shall certainly be blamed by the archæologists of those times as severely as we blame our predecessors, and we shall equally deserve it.

There are, however, ulterior objects whose attainment is possible only after a preliminary survey on large-scale maps. Such is the publication of archæological maps on smaller scales. I am not speaking of this now as a practical proposal of the near future, but as an ideal which must inevitably be achieved sooner or later. The preliminary large-scale survey has many other uses, but this ideal is its mainspring. Obviously in preparing an archæological map on a small scale, the same procedure should be adopted as in the making of the map itself in the first place.* During the revision which has already taken place, I have given a good deal of attention to our oldest and much neglected ancient monuments, namely, Long Barrows. A Long Barrow is a mound of earth, generally about 150 feet long, broader at one end, and covering the remains of bodies buried there in the Neolithic Age. In regions where stone was available, burial-chambers were built and the whole mound surrounded by a (generally rectangular) wall of dry masonry. I have compiled a descriptive list of these in Gloucestershire, and propose to continue this list until it is complete for all the southern counties. The idea was suggested by a list of these in Wiltshire made by Mrs. Cunnington and published in the *Wiltshire Archæological Magazine* (vol. 38). The lists will be supplemented by a map on the $\frac{1}{4}$-inch scale showing their distribution. So far as can be seen at present, the distribution of Long Barrows indicates several interesting geographical features. They occur in groups generally on limestone (carboniferous, oolitic or cretaceous); and within these areas they are not quite evenly distributed but cluster most thickly in the neighbourhood of perennial streams: particularly where several such streams converge, as near Swell in Gloucestershire and Stonehenge in Wiltshire. I would remark in passing that their abundance round Stonehenge cannot have any causal connection with that monument, because it had not then been constructed; and therefore a geographical explanation is more likely to be correct. A pastoral people could not wander far from water, and would make their principal burial-places near their principal camping-grounds. However, it is not possible here to do more than suggest some of the fascinating results which follow from the somewhat tedious work of compiling these descriptive lists.

In addition to Long Barrows, a list is also being made of Stone Circles, but they are not sufficiently numerous in the area so far dealt with to have much geographical interest.

Another quite different line of research is concerned with old large-scale plans of private estates and parishes. A great number of such maps exist in estate offices and elsewhere. Some of them are in imminent danger of destruction or loss, especially when properties change hands. Whenever possible these maps are borrowed from their owners and photographed to the uniform scale of the 6-inch map, so as to facilitate

* The present 1-inch map is founded entirely upon the 6-inch and 25-inch maps and has been since 1870 (Report of Departmental Committee, 1893, p. vii.).

comparison. Amongst those which have already been photographed is a valuable series at Bowood belonging to the Marquess of Lansdowne. It is hoped to deal with other collections while attention is being given to a county during revision. It will hardly be necessary to enlarge upon the value of such maps. They often form the sole connecting link with the Middle Ages and through them back into the dim past; and they are a storehouse of information bearing on every problem the archæologist has to solve. When used as raw material they are peculiarly instructive; and I hope it may be possible in some cases, by transferring their detail to the accurate framework of the Ordnance Maps, to show (for instance) the evolution of a town or region during the last few hundred years. This, to my mind, is the only way in which any such evolution can profitably be shown. To publish a series of reproductions of old maps in different scales and with different orientations is of course a valuable piece of work, and it provides the raw material for the uniform series I have in mind. But it is only a preliminary.*

It would, however, take me too far afield if I were to attempt now to do more than suggest some of the more promising lines of inquiry which are opened up by a geographical treatment of archæological material. I have barely touched the fringe of my subject, which is a wide and most fascinating one.

Before the paper the PRESIDENT said: I have much pleasure in introducing to you Mr. Crawford, who has been recently appointed Archæology Officer to the Ordnance Survey: the first appointment of its kind to the National Survey.

Mr. Crawford then read the paper printed above, and a discussion followed.

Colonel Sir CHARLES CLOSE (Director-General of the Ordnance Survey): First of all, I should like to thank the Society for having introduced this subject. It is one which personally interests me very much, and one that I feel we are bound to take more trouble about, because in the past we have dealt with archæology very much as well-intentioned amateurs do. As a result we have made a certain number of mistakes. I feel that the maps ought to be beyond reproach, and so some years ago I consulted some leading archæologists with a view of removing this reproach—such as it is—and we were strongly advised to obtain the services of Mr. Crawford. I am glad to say we were able to obtain his services and to offer him the post of Archæology Officer of the Ordnance Survey. I am inclined to think if Mr. Crawford is given some ten years or more of this kind of work we shall see our maps in an extremely good state from the archæological point of view. We shall no longer find on the maps such attributions as "Druids' Altar" and "Danes' Fort," and it seems to me we shall find a large number of discoveries which ought to have been on the maps and are not now on them. I do not want to give the impression that the maps are in a bad state; there is a great deal of excellent stuff on the maps, but it wants pulling into shape. I take it that the archæologists do use Ordnance Survey maps, but I hope in the future they will be more

* In the Bristol Museum is displayed a series such as one would like to see for every town; and I am told that a similar series exists at York.

useful to them than in the past. It is not safe to rely on the evidence even of the finder of a discovery. I came across an instance of this the other day. My gardener found a handful of copper coins and took them down to what he considered the best authority, namely the local pawnbroker, and he was told they were far too old to be of any value at all, and so he threw them away! I feel, therefore, that if we pursue this subject under the guidance of an expert like Mr. Crawford we shall find the maps themselves of much greater interest to the ordinary purchaser, and I look upon it as a good investment. I should like to thank the eminent archæologists who have assisted in this work, the Society of Antiquaries, and also the local bodies, and particularly the county correspondents, for helping us to make what I hope will be a really successful effort to put the archæology of the Ordnance Survey on a sound footing.

Sir HERCULES READ: It is very kind of you to have asked me to come here this evening, and it has given me very great pleasure to hear, in the succinct way in which Mr. Crawford has put the matter before us, what precisely is the scheme that the Survey has in view, so that we may look forward to finding these archæological matters set out clearly upon the ordinary Ordnance map. Mr. Crawford knows very well that for some time past I have had a good deal to do with the details of this scheme, and we have had many meetings and thrashed it out in the form of the printed memorandum in a fairly practical way, so that a person who is not an expert can have something reliable to put down upon the map which is entrusted to him to be brought up to date. The Society of Antiquaries also has not been entirely idle, even before this scheme came into being. I should think it is quite forty years ago that we began a series of archæological surveys by counties, and a certain number of these were published—I forget how few, because the difficulty was to get a competent authority to take the matter in hand; and to work the thing out and bring out a complete conspectus for each county involved a good deal of research in books as well as in knowledge of the county itself. We brought out a certain number of these surveys, but for practical purposes we found it expedient to restrict the date to the Saxon period. But the Society did attempt something of this sort, and I am very glad to find that our limited funds and energy will now be relieved by shifting the responsibility of the publication from the shoulders of the Society to those of the Ordnance Survey. It might seem rather remarkable that the Ordnance Survey should take such a keen interest in archæology. For my own part I am not really surprised, because for many years past I have had a good deal of correspondence with the Ordnance Survey on these matters, but it is, I think, not a little singular that during the last twenty years or so there has been a tremendous interest on the part of what I suppose may be called the Government, in the matter of archæology. For many years my old friend General Pitt-Rivers had no money and no power as Inspector of Ancient Monuments. Then comparatively recently another friend of mine has been appointed, and has got assistants under him to deal with these remains, and he has ample powers. The Ancient Monument Act now in force is of an unusually drastic character, but thoroughly beneficial, because while it takes away from the owner of the ancient monument nothing he can really value, yet at the same time it maintains through the State, and for the world at large, the integrity of the monument scheduled. We have an Historical Monuments Commission now at work, and it has published most admirable volumes of records, drawings, and plans of historical monuments all over the country, so that having regard to what has taken place it is not singular, but it seems to be the proper thing that the Ordnance Survey

should now take up the recording of ancient sites and monuments from the archæological side upon their maps. I think Mr. Crawford will have an admirable army of helpers right and left. When I say "admirable" I mean they will be full of enthusiasm, but that is not the only thing that is required. What is absolutely necessary in maps of this sort is, as far as human intelligence can reach it, accuracy; and as the Director of the Ordnance Survey has been saying, we have all sorts of remains all over the country, the majority of them wrongly named in the sense that they correlate an entirely wrong period. All this comes to Mr. Crawford to put straight and put down in strict archæological terms on these maps, and it is a very responsible job. Mr. Crawford mentioned one man among his correspondents, Mr. Heywood Sumner, who, in my judgment, is an accomplished artist, an extremely careful observer, and an enthusiastic and competent archæologist. When you get these three factors rolled into one man, I think Mr. Crawford may very fairly trust anything he gets from Mr. Sumner in the county of Hampshire. There is a much wider bearing of these archæological facts than the bare indication that here is a boundary, or some kind of stone monument. As I dare say some of you know, archæology of late has taken the line of being comparative, like other branches of science, and deductions are made from the existence in this or the other area of relations between peoples, or of the evolution of customs in one place or another, and thus we may eventually get relations of peoples or tribes or races in the various parts of these islands, by which we can say that at a particular period, perhaps the seventh or sixth century, a tribe of what are commonly called Saxons, but may be called with more precision "Angles," came over and settled in Suffolk, and were intimately related with another tribe, because having got the indication on the map of particular types of burials in one area, they could be compared by any observer with a similar group in another area say 50 miles off. If found to be identical, I think the archæologist is very reasonably entitled to draw certain deductions from that fact alone. If all the conditions and the method of burial are identical, we are entitled to set down as a working hypothesis that here you have two groups of people closely connected by race and connected also in point of time, and thus by means of these maps it may be possible for the historian to sit down with them and, with hardly anything else, to work out, as it were, a population scheme of all the early races of Britain more or less accurately. At any rate, I hope I have made clear that here you have a much wider interest in these archæological Ordnance Survey maps than the mere setting down of the bare period to which they belong. I think that as they go on, and the more elaborate they become, the greater their historical value will be. This is all that occurs to me to say at this moment, and I am very glad to have heard Mr. Crawford's account of his scheme, and I warmly congratulate the Ordnance Survey on having been able to secure his services.

Dr. DUCKWORTH: The first thing that struck me about Mr. Crawford's most interesting paper was the effort he had made for co-operation with all archæological bodies. As secretary of the Royal Commission, I know the difficulty in securing that co-operation, and finding out who are the right people with whom to co-operate, because there are so many who may lead you further astray rather than help you in deciding on archæological matters. Mr. Crawford, I know, has taken particular pains to secure co-operation and to find out who are the best people. Now he proposes to put upon the maps all the information he can gather with regard to these historical and ancient monuments up to the year 1688. As you have heard to-day, Mr. Crawford

rather confined his remarks to Long Barrows and prehistoric monuments, but I would ask Mr. Crawford if he does not intend to mark ancient monuments up to the year 1688. If so it is a very big job, and as Ordnance Survey maps are meant for the use of the people besides archæologists, I am a little afraid that they will be overladen if all is put in that we on the Historical Monuments Commission have included of ancient monuments dating from the earliest times to the year 1714, which is the limit of our investigations. If you put in all the houses in a street in a village, as we often have to, and visit each one in turn up to the year 1688, it is a very very long job. I would suggest to Sir Charles Close and Mr. Crawford that, if possible, they might limit the description and record of structures to the fourteenth century and before, and perhaps a few of the more notable structures from the end of the fourteenth century up to the year 1714. This extension would not, I submit, add a great deal to the work, while it would make it symmetrical with our date. It increases your work a little in towns, but does not affect it in the country, and if I may make a suggestion, it is this—to confine your monuments on the Ordnance map to a period between the earliest times and the end of the fourteenth century, and after that date be frankly incomplete and insert only some of the principal monuments that motorists like to visit. We on the Commission mark every one of the monuments from the earliest times to 1714 on the 6-inch map, and our duty is to go on doing this until the whole of England is covered. That will not be for sixty or seventy years. It takes us longer than the Survey, because, in addition to marking the site, we have to describe and make plans and photograph every monument. But wherever we have done the county Mr. Crawford will find we have the 6-inch maps with every monument accurately placed upon them, and as Mr. Crawford knows, the maps of the counties we have surveyed are entirely at his disposal—they are Essex, Hertfordshire, and Buckinghamshire. He can be secure in taking our maps and knowing everything marked on a particular site has been visited, has been described, and that the site is accurately marked. Now if Mr. Crawford confines his archæological statements on the maps to monuments up to the end of the fourteenth century, I should ask him to visit every one himself. It won't take a very great deal of time, and our experience is that you cannot be certain first of all that the monument is of the fourteenth century unless some one who is trained to know has seen it; nor can he be sure it is there even if he finds it on the map. For instance, the other day we went down to see Frating Abbey, which is marked in block letters on the Ordnance map near Colchester, but the experts who went down could not discover the site, nor have we been able to find out there was ever such a structure as Frating Abbey in existence. So that what I ask Mr. Crawford to do is, first to visit himself anything marked on the Ordnance map as an ancient monument and check its existence; and secondly to make his records complete as to monuments, say, up to 1349. With regard to those after the fourteenth century, he may be sure we shall come along with the Royal Commission and shall mark up all monuments up to the year 1714, and that their situations will be marked accurately. He will go quicker than we shall, but he will be able to help us a great deal if he will confine himself to the period I have mentioned.

Dr. J. W. EVANS: I should like, while congratulating Mr. Crawford on the excellent work he has been doing in connection with the Ordnance Survey, to draw attention to another class of antiquities to which reference has not been made—the local place-names which frequently come down to us from a remote past—and to express my anxiety that they should be correctly recorded on the

maps of the Survey. As a result of the spread of education the knowledge of the old local names among the people is rapidly disappearing, and when once the Ordnance Survey has entered a name on their maps it immediately acquires an authority which enables it to displace all other names which have been locally given to the same places. I would not propose that there should be any attempt to replace recognized names of towns by older forms, but there are many minor objects, such as country lanes, capes and bays, coves on the seashore, and the smaller streams which have got authentic names, and it seems to me highly desirable that the Ordnance Survey should take every care, in conjunction with archæologists who are qualified to advise them, in seeing that these objects are given their correct names. In many cases the names which appear on the 6-inch maps have no basis whatever, and sometimes they appear in the wrong places. "Sanda Bay" in North Devon is spelt "Sandy Bay," thereby disregarding the old North Devon genitive, and it is shifted at the same time to the next bay but two. In Sussex the Survey has given a particular wood the name of the Convent Wood on account of its proximity to a convent that only came into existence forty or fifty years ago. In the title deeds of the property this wood is known by an individual name, and yet it will go down to posterity as "Convent Wood." I think too it is highly desirable that the lists of fields, with their areas issued by the Survey, should give their proper field-names. Everybody who has had occasion to do any work which involves any examination of the different fields knows that though many of them are simply called the "Four-acre" or the "Five-acre" field, as the case may be, others have distinctive names which have evidently some significance. If, with the help of the tenants, owners, and antiquarians we can get the original field-names recorded in these lists, it will be of the very greatest value from the historical standpoint. We all know that the principles of agriculture in this country were changed in the sixteenth and seventeenth centuries. The country passed from the common field system to the present condition of separate farming, and in those local field-names you have many records of the old common fields system. I should like to conclude by acknowledging the magnificent way in which the Ordnance Survey has met the wish of archæologists, and hope that they will go one step further in the same direction and spare no pains to preserve the local nomenclature, which is often quite as ancient as the monuments themselves.

Mr. CRAWFORD: I said in my paper that the duties of the officer were not very light, but it seems that they will be very much heavier in the course of a few days if I have to visit all the ancient sites of the fourteenth century and to record every field-name in the British Islands! As a matter of fact, field and place names are outside my province. With regard to what Mr. Duckworth has said about the record of ancient buildings before the fourteenth century, I do not see that we can do more than is done at present. We record the ground plans of all existing buildings on the 25-inch map very minutely; no description is attempted except of historical or important buildings, ancient abbeys, and castles and such like. The majority of the later antiquities are, I think, already on the map, but it seems to me, so far as the archæological records are concerned, we can only go to the extent of *describing* the more important buildings. The ground plan of *every* building is of course shown on the 25-inch map. I need hardly say I should be only too glad to co-operate as far as possible in this matter with the officers of the Royal Commission. As regards the date 1714, it seems to me unfortunate that the Royal Commission did not adopt the date of 1688 when they started work. It would mean a good

deal of work to change it now, and investigating a great number of doubtful sites which fall between the two dates. Until the Royal Commission has been over the ground, it would be rather difficult to pick out the ones which should be shown as antiquities. I am very grateful for the offer of a loan of 6-inch maps, especially for Hertfordshire, and I should be very glad if I might go over them and extract from them information for the new edition.

The PRESIDENT: I hope that the lecturer will not be alarmed by what is expected of him; but, at any rate, he will know we realize the great value of the work he is doing. I am sure you would all wish me to thank him for his lecture this afternoon.

Sir CHARLES CLOSE writes: Dr. Evans has raised some questions of interest connected with the spelling of place-names on Ordnance maps. This subject has been very carefully considered during the past hundred years, and no pains are spared to obtain the correct spelling; but we are bound by normal, modern, educated usage, and cannot adopt archaic forms, such as "Sanda" for "Sandy."

With regard to the names of fields, this matter has been constantly under discussion. The chief reason against printing the field-names is the expense involved, and this reason is nowadays more cogent than ever. But there is also to be considered the fact that, if all field-names were inserted, the 6-inch sheets would be unduly crowded. We do already print field-names of exceptional interest.

As to "Convent Wood," if that is the present local name the Survey has no choice but to adopt it: the Department does not go about inventing names.

I have looked up the position of Sandy Bay on 25-inch sheet Devon V.3, and find that this name appears to be properly authorized and to be in its correct position on both 25-inch and 6-inch scales.

THE EMPEROR KANG HSI'S EDICT ON MOUNTAINS AND RIVERS OF CHINA

W. R. Carles, C.M.G.

IN order to complete the work carried through by the Jesuit missionaries at Peking in the production of a map of the Empire of China, a final mission was despatched by the Emperor Kang Hsi to map out Tibet, where a recent campaign had added fresh domains to his realm. And, following on their report, an Edict on the Great Rivers and Mountains of China was published by the Emperor in the winter of 1720–21, a translation of which is appended.

The conclusions arrived at by the Commission were accepted in Europe as decisive. But excellent as the maps were in giving a picture of the general features of the country and the relative positions of towns, rivers, and mountains, it had been impossible for the various commissions in the short time at their disposal to visit all the places covered by their maps, and as time went on inaccuracies were discovered which in some small degree impaired the value, without in any degree diminishing the

high estimate, of the work done by the distinguished men to whom the task had been entrusted.

More especially within the last fifty years foreign travellers have done much to add to our knowledge. The journeys undertaken by Prjevalsky dating from the early 'seventies of the last century, and by Sven Hedin in more recent years, may be cited as among the most thorough of these investigations; but the list of names, French, German, British, Austrian, Russian, American, and Japanese—indeed of almost all nationalities except Chinese—who have rivalled each other in the exploration of hitherto unknown tracts, is far too long to be given even in part. It may however be perhaps added that the knowledge of southern Tibet has been enormously extended since the British expedition to Lhasa in 1904 opened the way to travellers in regions where scientific investigation had previously been impossible except under conditions which seriously hampered those who risked their lives and labours in the attempt.

In his survey of the courses of the great rivers the Emperor divided them into three groups. In the first he placed the Yellow River; in the second the rivers whose sources were separated from those of the Yellow River by the great water-parting of the range known to him as the Nomokhun *ubashi ta-kan;* and thirdly those rivers which find their way to the Indus or Ganges.

With regard to the Nomokhun *ubashi* range, which Kang Hsi claims to be the water-parting between the Yellow River and the rivers which drain to the south of it, a difficulty exists in the fact that though two ranges of the name are known, the one lies to the north of the Yellow River, and the other to the south of the Di Chu or Chin-sha Kiang, so that neither constitutes the water-parting between them. The north or small (bagha) Nomokhun corresponds to Prjevalsky's Burkhan Buddha (Prjevalsky, 'Mongolia,' 2, 175), bounding the south end of the eastern Tsaidam. This range is defined on the west by the Nomokhun-*ghol*, which flows from its southern foot, sweeps round the western end, and enters the Tsaidam plain, where it joins the Baian-*ghol*. The name, which signifies Vice Khan, is also given to a town, Nomokhun *Khoto*, which lies to the north of the range, and to a pass (Kozloff, *R.G.S. Journal*, 31, 406 and 408), Nomokhan *daban* (16,030 feet), on the road from Si-ning Fu to Lhasa.

The Ike (great) Nomokhun-ubashi is shown in Delmar Morgan's (*R.G.S. Proceedings*, 9 (1887), pp. 330 and 398) and General Walker's maps as extending in an approximately north-east to south-westerly direction from the Tang-la Mountains to the valley of the Di Chu, but later maps, *e.g.* Dr. Tafel's 'Meine Tibetreise,' do not mention the range, and it is probable that some modification in its direction is necessary.

Passing from the Yellow River, the source of which he places in Odontala, the Emperor proceeds to survey the Yangtse and those of its tributaries which have their rise in the west of China, and starts with the

Min River which Chinese geographers regard as the main river. This he says rises to the west of the Yellow River at Ch'i-ch'i-la-ha-na in the Baian Kara range, which is called in Tibetan Maniak chyok,* and in the "*Han shu*," the Min Mountains. He also refers to the ancients as having known that the sources of the Min and Yellow Rivers were near each other, and in support of this view endeavours to explain away a statement in the *Yü Kung* that the Great Yü† had surveyed the river from Min Mountain by asserting that this refers to its course and not to its source.

It is however in the Min Mountains that the Min River has its source. D'Anville's map, the materials for which must have been in the Emperor's hands, shows this correctly, but the Emperor seems to have confused the Min with the Yalung, which does rise in what Chinese geographers regard as the Baian Kara range, and not very far from Tsitsirkana, presumably the Ch'i-ch'i-la-ha-na of the text, mentioned by Du Halde as a town *en ruines*.

The absence of any reference by the Emperor to the Yalung‡ as such is the more striking, as it is probably one of the best known of all the rivers bordering East Tibet, main roads from China to Lhasa crossing its valley.

Concerning the Chin-sha Kiang, which by Europeans is regarded as the main stream of the Yangtse, the Emperor says little of note, but mentions the Muru-usu as its headwaters in Tibet, omitting to mention the two large confluents Toktonai and Napchitai-ulan-mursen. Nor is any word said of the extraordinary bend of the river at Li-kiang Fu.

The Emperor next proceeds to discuss the rivers rising on the south-east of the "*Nomokhun ubashi*," whose waters drain to the south, and after giving some details regarding the Lan-tsang, or Mekong River, attacks the Salween. This river, known to him as the *Hei-shui*,§ or Black Water, has its origin, he states, in Kara Nor, or "Black Lake," to the north-east of Lhasa, and after passing through Kham enters Yunnan.

The precipitous nature of the valley of the Salween, penned in between the Mekong–Salween and Salween–Irrawaddy divides, and its dense vegetation and high temperature in the monsoon region have constituted serious barriers to its exploration, and it has been only bit by bit that its course has been surveyed as far north as about lat. 28° 40′ N. by such travellers as Prince Henri d'Orléans, Capt. Bailey, Messrs. Litton, Forrest, Kingdon Ward, and Teichman. Above that latitude little is known, though Messrs.

* Country of the Maniak or Menia.

† The Great Yü, who is regarded by Chinese as the saviour of the country from the great floods which inundated it in his days, was appointed to the post, in which his father had failed, of dealing with the floods, and in nine years of indefatigable labour he accomplished the great work (B.C. 2278). Later on, in recognition of his unexampled services, he was made co-regent with the Emperor, and on the latter's death became his successor.

‡ Also known as the Nya-rong, Nag-chu, or Dza-chu.

§ Above Menkong it is known as the Giama Na Chu, or Gyamo Ngo Chu.

Bonvalot, Dutreuil du Rhins, and A. K. have crossed it in its higher waters; and it remains yet, I think, to be proven that the river rises, as stated in the Edict, in the "Black Lake," near Lhasa.

Although the Kara or Hara Nor made its appearance on European maps a century and a half ago, its site seems to have been never visited by Europeans, and even its existence and connection with the Salween system can hardly be taken as established. It was the lowest of the chain of lakes shown by D'Anville (from Chinese sources) as connected by a river making a remarkable bend to the north before flowing east to the Salween under the successive names of Kara-ussu (Tibetan Nak Chu), Oir Chu, and Nou-kiang. On the map of Nain Singh's journey of 1874–75 a whole chain of other lakes was added to the upper basin of the Nak Chu, the pandit having understood that most of the lakes seen or heard of by him to the north of his route were drained to that river: the basin of the Salween was thus extended west to about $83\frac{1}{2}^{\circ}$ E. long. This improbable idea was afterwards disproved by the journeys of Bower, Littledale and others, but even the most recent maps assign *one* lake to the Nak Chu—the Amdo-tsonak, occupying about the position of D'Anville's Kara Nor. This lake appears to have been heard of by Prjevalsky during his journey of 1879–80, on which he crossed the Nak Chu some distance below its supposed exit from the lake. The old Chinese authorities, and their interpretation by D'Anville and Klaproth, are fully discussed by Dutreuil de Rhins in his big book on Central Asia, compiled by him before his own fatal journey to Tibet.

The only Europeans to have actually sighted the Upper Salween between its crossing by the northern road from Lhasa and its intersection with the 29th parallel appear to have been Huc and Gabet, who crossed it at the site of the ruined bridge at Kia-yu-kiao (D'Anville's Pont Sapia), on the eastern road from Lhasa to Chiamdo, during their return journey to China under arrest.

Of another theory started by the Emperor later in the Edict in which he identifies this river with the "Black Water" mentioned in the *Yü Kung* as having been surveyed by the Great Yü, it may confidently be stated that the Emperor is mistaken. Chinese scholars are agreed that the river in question lies in Kansu.

In the latter part of the Edict, the Emperor is frequently diverted from geographical to other considerations, through the historical and legendary circumstances connected with the surroundings. But first he is led through imperfect reports to assign the waters of the Yaro Tsangpo in Tibet as the source of the Irrawaddy.* Strangely enough the name Ping Lang (Betel Nut) given by him to the Irrawaddy is not the name of the main river, but

* The connection of the Tsangpo with the Irrawaddy was proven by A.K. to be impossible (*R.G.S. Proc.* 1885, p. 65), but its connection with the Brahmaputra through the Dihong River, though long presumed, was not positively established until 1913 (*R.G.S. Journal*, Bailey and Morshead, 44, 342 *et seq.*).

of a confluent known to us as the Ta-ping, which joins the main river a little north of Bhamo and is shown as such in early Jesuit maps.

It is small wonder that the sources of the Irrawaddy were not discovered during the hurried survey of China undertaken by the Emperor's orders. The Irrawaddy is formed by the confluence above Myit Kyina of two rivers, the Mali Kha and N'mai Kha, of which the latter, the eastern branch, is formed by the waters of the Kalaw Long and Taron. The river was explored in 1911–12, up to the junction of these two branches, by Capt. B. S. A. Pritchard, who was afterwards drowned in the Taron. The higher waters of the Kalaw Long were crossed first by M. Bacot and afterwards by Capt. F. M. Bailey, who found, as he thought, the source of the Irrawaddy near Tsong La (*circa* 28° 30′ N., 97° 50′ E.), but it was reserved to M. Bacot (M. Bacot, 'Le Tibet Révolté') later on to discover the real source in Lagen La glacier in about 28° 40′ N. lat.

The Mali, the west branch, rises in Hkamti Long, some distance to the south-west of the glacier, and south of lat. 28°.

Of the Yaro Tsangpo's course in Tibet there is much in the Edict which is correct and interesting. Its source is placed east of Kang-ti-ssu Mountain in Tam-jyak Kabab, a position which would seem to correspond with the Mariam or Mayum Pass, where Capt. Ryder found it,* and the surroundings are completed by Kang-ti-ssu Mountain on the north; two lakes connected with each other, through which flow the headwaters of the Sutlej, to the west; and a mountain unnamed to the south. These details lead to the identification of Kang-ti-ssu with Mt. Kailas (21,830 feet), of the lakes with Mabang or Mansarowar, also known as Lagang or Rakas Tal, and of the mountain on the south as probably Gurla Mandhata (22,850 feet).

The remainder of the river's course is briefly given as passing from Ari to Tibet, turning south at some distance east of its junction with a river, possibly the Ki river, west of Lhasa, and after traversing Kong Bu entering Yunnan in Ku-yung Chou, and thence flowing into Burmah. It was but natural that the course of the Tsang-po should have been lost in the labyrinthine cañons which separate China from eastern Tibet, but it is curious to find the claim to the river reappearing in Ku-yung Chou, which lies some 30 miles east of the main valley of the Irrawaddy and not far from the source of the Ping-lang River, by which name the lower Tsangpo was designated by the imperial geographer.

From this point on the geographer loses himself in the antiquarian and student. After giving some details regarding the three other great rivers, the Indus, Sutlej, and Karnali, which rise in the neighbourhood of Kang-ti-ssŭ, he conjectures that Kang-ti-ssu must be the same as the Anouta Mountain from which Brahmans say that the "four great waters" issue; that this is the mountain of which Tanguts speak as the root of

* Sven Hedin determined the source to be a little to the south in a mass of glaciers called Kubi Gangri.

all mountains and rivers; and that the two lakes before it are the Anouta lakes, where local tradition places the home of Si Wang Mu, the Venus of China.

When he speaks of Anouta Mountain, he has in his mind the mountain more familiarly known to us as Sumeru, or Meru, which Tibetans hold ('The Buddhism of Tibet,' Waddell, p. 81) is "the very centre of the cosmic system, towering erect like the handle of a millstone, with halfway up its side the great wishing-tree, the prototype of our Christmas tree and the object of contention between the gods and the Titans."

Si Wang Mu, the goddess to whom Kang Hsi assigns this mountain as her home, is famous in Chinese history and legends as having entertained King Mu when on a shooting expedition (1000 years B.C.), and as having, 1000 years later, favoured another Chinese sovereign with her presence. Her home (Mayer's 'Chinese Readers' Manual,' "Kwén Lun," p. 108) in the Kun-lun mountains was 10,000 *li* in circumference and 11,000 *li* in height. Its walls were piled in nine-fold gradations, and on the mountains grew the trees of pearls, jade, chrysoprase, and immortality. At its foot lay the Lake of Gems and the blue, white, red, and black rivers.

To us she lives in pictures on silk and porcelain, with her gardens, pavilions, lakes, and bevies of attendant maidens. But the fact that the story of the recovery of the book which tells of King Mu's visit to her was discredited by Chinese scholars, and that the portions of the volumes said to have been saved from the destruction of the Classics and to have been recovered together with the Bamboo books in 281 A.D. were regarded as spurious * and ascribed to a later date, has not only checked careful investigation of the book and inquiry into the exact locality of Si Wang Mu's home, but has also prevented the legend from obtaining any great hold in China except on the artistic world and Taoists.

But in India from the earliest days the somewhat similar legend regarding Shiva and Parvati has invested their abode in Khailas Mountain (Kang-ti-ssu) with an attraction which has overcome all difficulties of travel. Over passes of 17,000 feet and more a stream of pilgrims has poured for many centuries to do worship to the god and make the circuit of the mountain.

The beauty of the lakes at its foot and the grandeur of the mountains have asserted an overpowering hold on the imagination of the people, of which no better picture can be given than that in the early Sanskrit epic (Atkinson's 'Himalayan Districts' and Sherring's 'West Tibet'), the Ramayana, relating to the Aryan advance into south India.

Of the rivers which flow from the Khailas neighbourhood and which form so great a feature in both Indian and Chinese legends, the identity is established by a map made by Chinese pilgrims in the fifteenth century,

* Recently M. de Saussure has written maintaining the genuineness of this history, and has adduced much evidence in support of his theory (*Journal Asiatique*, July–September, 1920, and April–June, 1921).

of which a reconstruction appears in Atkinson's 'Himalayan Districts.' But I have found it difficult, in most cases impossible, to identify the places and countries through which they are said to have their course.

The language of this part of the Edict also presents difficulties which makes me doubtful as to whether the translation is correct; but throughout I have found myself treading on ground of which I had little or no knowledge, and have had to rely on the assistance of friends. Among these I have been specially indebted to the late Mr. Thomas Watters, whose notes written twenty-odd years ago were the main cause of my undertaking this paper; Dr. W. Crooke, C.I.E.; Prof. E. H. Parker; Mr. W. A. Hertz, C.S.I.; M. L. de Saussure; and Mr. Edward Heawood.

Though the Edict contains nothing which adds to our present knowledge of the country under survey, it is interesting as presenting a picture of what was known in 1721. Further, though many of the theories put forward by the Emperor appear incorrect, it must not be forgotten that it is to his encouragement we owe the Jesuit maps of China, and that his last charge in the Edict is to "ascertain the names of rivers and mountains" of China, and thus supplement the knowledge of his day.

Translation of Edict in the 11th Moon of the 59th Year of Kang Hsi (end of 1720 or beginning of 1721) **to the Secretaries and Assistant Secretaries of the Imperial Chancery and the Nine Ministries.**

From our youth up we have given attention to geography. The names from antiquity until now of all hills and streams, even those in the frontier regions and remote deserts, we made a point of ascertaining correctly by study of maps and records and wide investigation of local opinions. For this purpose we sent Commissioners to all the K'unlun and Si-fan country where they saw with their own eyes the various places where rise the Great River, the Yellow River, the Black Water [Salween], the Chin-sha, and the Lantsang [Mekong], and after full inquiry made the necessary entries in maps. Now that our army has conquered Tibet and the various tribes (Fan) outside the frontier have heartily embraced civilization, the lands of the three Tsang and Ngari* are all inscribed in the map of the realm, it is proper at this time to verify exactly the variations between Chinese and Fan names for hills and streams so that the truth may be handed down to posterity.

Speaking generally, all the great waters of China issue from the south-east Nomokhun† wu-pa-hsi [ubashi, Klaproth], inside or outside the trunk chain [*takan*].‡ The particulars can be obtained and enumerated.

The Yellow River has its source beyond Si-ning on the east of the Kulkun mountains. The group of springs is so widely scattered that they cannot be enumerated; seen from a distance they sparkle like a set of stars. The name in Mongol is Odontala, in Si-fan Solomu, in Chinese Sing-su-hai. These are the sources of the Yellow River, and after uniting in the Sa-ling (Charing) and

* Western Tibet, Ngari, or Hundes.

† *Vide* 'Mongolia,' Prjevalsky, vol. 2, p. 175.

‡ *Takan* perhaps = water-parting. It is interesting to compare this statement with the map published in the *R.G.S. Journal*, 31, p. 405, showing routes of Captain Kozloff's expedition, in which the dividing ranges between the great rivers are clearly marked.

Oling (Oring) Lakes and flowing south-east, the river bends north and again east and passing by Kuei-te-pui * and Chi-shih Kuan † enters Lan-chou.

The Min River has its source to the west ‡ of the Yellow River at Ch'i-ch'i-la-ha-na in the Baian Kara range, which is called in Tibetan Meniak-chyok § [country of the Maniak or Menia] and in the "*Han Shu*," the Min Mountains, beyond the western frontier [of China]. This is the source of the Kiang ‖ [Yangtse River], and the place mentioned in the "*Yu-kung*" as that where the great Yü surveyed and described the Kiang is Nai-chu Shan, beyond ¶ Huang-shêng Kuan in present Szechuen. The ancients spoke of the sources of the Kiang and the Ho [Yellow River] as adjacent, and the survey of the Kiang from the Min Mountains was a survey of its course, not of its source. This statement can really be depended upon. Its [the Min's] waters flow from Huang Shêng Kuan to Kuan Hsien and there divide into several tens ** of branches, which reunite in one stream at Hsin-chin Hsien, flow south-east to Hsü-chou Fu, and there join the Chin-sha Kiang [River of Golden Sand].

The waters of the Chin-sha Kiang [River of Golden Sand] start from the Wu-ni-yin-wu-su peak, in the north-east of the Dalai Lama's territory, which in Chinese is called Ju-niu Shan.†† Its waters called the Mu-lu-su-wu-su [Muru-usu] flow south-east to Kham, and passing through Chung-tien enter Yunnan at Ta-ch'êng Kuan,‡‡ where the river is called the Chin-sha Kiang. On reaching Li-chiang Fu it is also called the Li-chiang. On reaching the Yung-pei Prefecture §§ it joins the Ta-ch'ung River ‖‖ and flows east and passing through Wu-ting Fu enters Sze-chuen. At Hsü-chou Fu it flows into the Min River, and passing Kuei-chou Fu enters Hu Kuang, and so by way of Ching-chou Fu and Wu-ch'ang Fu joins the Han River.

The Han Kiang under the name of Yang rises in the P'an ch'ung ¶¶ mountain in the north of Ning-chiang Chou in Shensi; flows east to Nan-ch'êng where it becomes the Han water, enters Hu Kuang and flows south-east to Hankow in Han yang Hsien, where it joins the Min Kiang.

All the above waters rise in south-east Nomokhun *wu-pa-shi* within the trunk range (*ta kan*) and from Tibet meander into China.

* Kuei-tê-ting is on the Kan-su frontier.

† North of Hsün-hua Hsien.

‡ The source of the Min is in the Min Mountains, many hundreds of miles from the headwaters of the Yellow River.

§ Cf. 'Land of the Lamas,' Rockhill, p. 218.

‖ The Chinese traveller Hsü Hsia-ko had one hundred years earlier discovered that both in length and volume the Chin-sha Kiang and not the Min River was entitled to be considered the main river (*The New China Review*, October 1921, p. 336).

¶ North of Sung-pan-t'ing.

** This refers to the immense system of irrigating canals conducted from Kuan Hsien to the T'o River, which supply the agricultural requirements of the plain which surrounds Ch'êng-tu Fu, the capital of Szechuen (*R.G.S. Journal*, 12, 231–3).

†† Is this a Chinese translation of Dichu, one of the names of the Chin-sha River? Ju-niu, "milch cow"; Dichu, "Cow-yak River."

‡‡ Ta ch'êng Kuan, on the right bank of the river, is on about the same latitude as Chung-tien, which lies some miles east of the river.

§§ No mention is made of the extraordinary bend made before reaching this point. Yung-pei and Wu-ting cities lie at a considerable distance from the river, and neither of them holds the rank of a Fu.

‖‖ It is strange that so little is said of this river and its greater confluent the Ya-lung.

¶¶ P'an-ch'ung Shan in the Chin Ling is a few miles south of Ch'in Chou in Kan-su.

The Lan-tsang [Mekong] has two sources :* the one in the Ko-erh-chi-tsa-ko-erh Mountains in Kham called the Tsa Chu; the other in Chi-lu-kan-ta-la called the Ao-mu Chu River† [Om Chu]. The two streams meet south of Chiamdo Lamasery, are there called La-ko Chu River, and flow south into Yunnan, where they become the Lan-tsang Chu River, [thence] flow south to Ch'o-li *hsuan-fu-ssu*,‡ where they receive the name of Chiu-lung Chiang [Nine Dragons River] and enter Burmah.

To the west of the Lan-tsang the Kara-usu, the Hei Shui [Black Water] of the *Yü Kung*, which in Yunnan is now known as the Lu Kiang [Salween], issues from Ha-la Nao-erh [Kara Nor] on the north-east of Dalai Lama.§ Flowing south-east it enters Kham, and continuing its south-easterly course enters the Nu-i country, where it becomes the Nu-kiang, enters Ta-tang-ai‖ [gorge] in Yunnan, changes its name to Lu-kiang, and flowing south through the Lu-kiang aboriginal district in Yung-chang Fu enters Burmah.

To the west of the Lu-kiang is the Lung-ch'uan Kiang [Shwéli]. The Lung Ch'uan rises in the Chun-to range in the jurisdiction of Kham,¶ and flowing south enters the Ta-t'ang-ai in Yunnan. Flowing west it becomes the Lung-ch'uan Kiang, reaches Han-lung Kuan and enters Burmah.

All these rivers are on the south-east slope of Nomo Khun *ubashi* outside the trunk range, and all flow into the South Sea.

Again, on the frontier of Yunnan is the Ping-lang River. Its source** is to the east of Kangti-ssŭ,†† in Ngari, in the Ta-mo-chu Ko-pa-pu [Tamjok] Kabab,‡‡ a name meaning Horse's Mouth. A spring flows forth and becomes the Yalu [Yaro] tsang-pu Kiang. Making a bend from south to east it passes through Tibetan territory, and alongside the town of Jih-ko Kung-ko-erh it joins the Ko-erh-no-mu-lun Kiang.§§ Again flowing south it passes through

* Mr. E. Teichman writes me the three main branches of the upper Mekong above Chamdo are (from east to west) Dze Chu, Dza Chu, Dje Chu, the latter lower down called Ngom Chu. Below Chamdo it is called Dze Chu, and in Merkam down to Yen-ching La Chu and also Da Chu.

† The title by which the kingdom of Ch'o-li is designated by China.

‡ Lhasa.

§ Ta-t'ang-ai is one of the ten gorges in the river. Prof. E. H. Parker informs me that the Kakhyen chiefs (Tsawba) were all kings of an *ai*, or a hill, and all the ten *ai* of the Yung-chang neighbourhood were kingdoms of either Shan or Kakhyen chiefs. The explanation of the Salween and Shwéli both passing through the Ta-t'ang *ai*, as stated in the Edict, may therefore be that the *ai* here refers to the district governed by the Ta-t'ang chief.

‖ The Lung ch'uan rises in Yunnan.

¶ The source of the Brahmaputra with which the Irrawaddy is here confused has been determined by Dr. Sven Hedin to lie (15,958 feet) in Kubri Gangri, to the south-east of the source of the Sutlej ('Trans-Himalaya,' 2, 100).

** Colonel Waddell, C.B., informs me that *Tïse*, or as it is fully written *Tïretse*, literally "the three-peaked," is a Tibetan translation of the Sanskrit *Tri-kūta*, the three-peaked of the Sanskrit Epics (*Vishnu Purana*).

†† *Kabab* = source ; *Kamba* = river.

‡‡ In Chinese maps there is a river Ko-erh-ka-chu mulun, the course of which corresponds with the Ki Chu in Markham's 'Tibet,' the Kyi Chu of Ryder's map (*Geographical Journal*, 31, p. 480), joining the Tsang-pu south-west of Lhasa.

§§ The Sutlej has had its source fixed by Dr. Sven Hedin at the head of the Tage Tsangpo in Gang-lung Glacier, south-east of Mansarowar. The first two volumes of his 'South Tibet' are devoted to questions arising out of early travellers' reports on the connection or disconnection of these two lakes and their confusion of the Sutlej with the Ganges, possibly owing to the channel between the lakes bearing the local name of

Kung-pu Pu-lo [Kong-bu] territory, enters Yunnan at Ku-yung Chou, where it becomes the Ping-lang [Betel Nut] River and passes by Tieh-pi Kuan into Burmah.

To the south of Kang-ti-ssü is a mountain called Lang-kan Ka-pand [Lang-chin Kamba, Tib.], meaning Elephant's Mouth. A stream * rises there which flows to Ma-pi-pu-ta-la [Mansarowar Lake], and then enters the Lang-ka Nao-erh [Langak Nor or Tso]. The waters of two rivers † run west to Sang-nan territory.

To the north of Kang-ti-ssü is a mountain called Sêng-ko Ka-pa-pu [Sing-chin Kabab, Tib.], meaning Lion's Mouth. A stream ‡ issues from it going west and also comes to Sang-nan territory.

Two waters unite, flow south, then make a bend east to Na-ko-la Su-mu to [Nepal sumdo? §], and join a stream which comes from Ma-pu-chung Ka-pa-pu Mountain on the west of Kang-ti-ssü. The meaning of Ma-pu-chung Ka-pa-pu [Mapchu-*Kabab*] is Peacock's mouth.

This stream ‖ goes south to Na-ka-la *sumoto* ¶ territory, joins a stream flowing eastward, and then runs south-east to Ona-to-ko-ko territory, where it forms the Kang-ko-mu-lun Kiang, the Buddhist Hêng Ho [Ganges].**

The *Fo K'uo Chi* [Record of Buddhist Kingdoms] states that Fa Hsien †† followed the Hêng Ho to the South Sea and reached the Po Hai [Gulf of Chih-li] of Shantung. This must be the water mentioned.

The *Fan Shu* [Pali or Sanskrit books] state that the four great rivers issue from Anou-ta Mountain. ‡‡ Below it is Anouta land.

In the light of present inquiry Kang-ti-ssü would seem to be the Kang-ti-ssŭ, of the Tanguts, said to be the root of all mountains and streams, thus agreeing with the statement in the *Shih T'ien* [Buddhist Canon].

In front of Kang-ti-ssü are two lakes, connected with each other. Local tradition makes them the Jasper Lake of Hsi Wang Mu, an idea answering to Lake Anouta.

Again, the *Fan Shu* speaks of three Pu-To Mountains, §§ one due south of

Ganga. One or other of the lakes has also been in the past erroneously claimed as the source of the Indus, Brahmaputra, and Karnali.

* "Two rivers." This may mean the original stream and the waters of the lakes. Chinese often describe such junctions as two streams.

† The Indus. Dr. Sven Hedin places its source north of Mount Kailas at the head of the Singi-Kamba (16,946 feet). The Gartong River, which rises to the west of Kailas, joins the Singi after the latter has made a long détour.

‡ Presumably this refers to two other rivers, but there has in the past been an entanglement by geographers of the sources of the Indus and Karnali.

§ Sumdo, Tib. = confluence of three streams.

‖ The Karnali, Gogra or Sarju.

¶ *Vide supra.*

** If I am correct in my division of paragraphs, and the "two waters" mentioned in the previous paragraph do not relate to the Indus, there would seem to be no foundation for D'Anville's error in placing the source of the Ganges in Mansarowar Lake. The fact that the sources of the Brahmaputra, Indus, and Sutlej are placed fairly correctly is very noteworthy. On the other hand, in the Chinese text "the two waters" are not distinctly separated from those of the Indus.

†† The celebrated Chinese pilgrim of the fourth century B.C.

‡‡ Anouta. Sanskrit Anavatapta; Pali Anotatto and Anavalatto.

§§ Regarding this the late Mr. T. Watters wrote me the following: "The first of Kang Hsi's three Pu-t'ê Shan is the Potalaka of Yuan-chuang's '*Hsi-yü-chi*,' *chuan* 10 (last page), and Julien, '*Memoires*,' 2, 123. There Puta-la-ko is a mountain to the east of Malaya in

O-na-to-Ko-ko in the sea. On the mountain is a stone Deva palace, a travelling lodge for Kuan-tzu-tsai Pu sa [Avalokitesvara]. This is spoken of as the true P'u t'o. One is in the sea in Ting-hai Hsien in Chekiang. It is the 28th place of consultation by *Shan Ts'ai* ["Virtuous Possessions"], and the spot where Kuan-yin Pusa expounded the law. One is in T'u-po-tê [Tibet], which in the Brahma language is called Pu-ta-la Mountain, and is also said to be the spot where Kuan Yin appears on earth.

The books of the Buddists originally came from the western countries, and so they may be cited as authoritative on the hills and streams of those lands.

The old commentaries explain *San Wei* in the passage of the *Yu Kung* "he surveyed the Black Water as far as San Wei" as the name of a mountain, the situation of which cannot be ascertained. It is only now that we have ascertained the truth. The San Wei are three Provinces of China. The land to the south-west of Tachien-lu, subject to the Dalai Lama, is a Wei country; south-east of La-li [Hlari] is Kham; the territory under the Pan-chen Erdeni Lama is Tsang. These three lands together are simply the San Wei. The Kara Usu [Black-Water] flows from this country to the sea. Hence the passage, "he surveyed the Black Water as far as San Wei, whence it goes to the Southern Sea." *

Although Tibetan names differ from those in the *Shih Ch'uan* [Historical Records] yet there are some to be relied upon. The present T'u-po-to [Tibet] is the T'u-chueh of the T'ang dynasty. In the time of T'ang T'ai Tsung [A.D. 641] a princess was granted in marriage to its ruler. The princess worshipped in the temple an image of Buddha, who in the Tibetan tongue is now called Chao-chao, which translated [into Chinese] is Ju-lai † [Fo]. The country still has a tradition that in the T'ang times China took away images of Buddha.

In the Chêng-hua period of the Ming Dynasty [A.D. 1464-1488] the U-ssu Tsang Prince of the Great Precious Law [Dharma Raja] came to Court and was escorted on his return journey by half an Imperial escort.‡ An eunuch was sent to take care of him, who on reaching the frontier of Sze-chuen was unable to proceed further and returned. His *i-chang* [staff] was kept in a

South India, but it is not 'in the sea.' The name Onatakoko does not occur in the *Hsi-yü-chi*, and it is evidently wrongly used here. . . . The second is the Isle of Puto, off the coast of Chekiang. Here the words 'It is the 28th place . . . expounded the Law' are a second-hand quotation or abstract from a great Indian Buddhist treatise translated into Chinese." The Emperor's statement was apparently taken from the Eastern account of Puto, and it remains in the latest edition. In the Scripture from which the statement is taken we have a curious allegory, giving the quest of a human soul after ideal spiritual perfection. The human being is born to an inheritance of fabulous wealth, and hence his name *Shan Tsai*. When this man is converted and sets himself to attain perfection he is sent to above fifty places, each with a great saint, in order to *Ts'an*, or take counsel. The 27th in the Scripture but the 28th in the Puto Topography is Potalaka, where Kuan-yin P'usa preaches. But in this Scripture Potalaka is on the *sea side* in South India, and is evidently the Potalaka of the '*Hsi-yü-chi*.'

* San Wei. It seems scarcely necessary to state that the Emperor's proposed identification of San Wei with Tibet is impossible. No Chinese treatise gives San Wei as a name for Tibet, and it is plain from his own words that there is only one Wei. The San Wei of antiquity was in Kansu, and apparently in the south-east part of the old province. So also the Hei Shui of the *Shu Ching* cannot be the modern river Kara-usu (T. Watters).

† Tathagata (Sanskrit).

‡ Indication of the rank conferred upon him.

Buddhist temple, and has been seen by many travellers up to the present day. This is recorded in the "*Ming Shih Lu*," the True Records of the Ming dynasty.

We charge you carefully to ascertain the names of mountains and rivers and report them to Us.

THE ECONOMIC LIFE OF THE BAFFIN ISLAND ESKIMO

Henry Toke Munn

THE economic life of the Eskimo cannot be judged from any one region. Recognized authorities describe the life of the Eskimo in the regions of their explorations, and the reader is apt to apply this information to the whole of the Arctic lands over which these interesting people are thinly scattered. For example, the Kinipitu tribe of Hudson Bay—inland dwellers—have forgotten the art of seal-hunting and many have never seen a walrus; the Igluliut tribe of Fox Channel have hunted and used the walrus for their main meat supply for the hundred years we know of and probably much longer. It is to the Eskimo of Baffin Island the following notes apply; they may be taken as quite inapplicable to the natives of, say, Coronation Gulf or Hudson Bay, where different conditions govern their economic life.

The Eskimo of Cumberland Gulf—the Tunnu-me-muit tribe—depend mainly on, and are expert hunters of, the ring seal (*Phoca hispida*). Some of these natives always go in the early summer to Lake Nettilling, taking with them a whale-boat, which they drag over the short portages from the head of the gulf. This is the largest known lake on Baffin Island, and numbers of cariboo summer on the numerous islands at its eastern side to get away from the flies. These hunters supply the winter clothing of cariboo skins—shot from August 1 to September 25—which are indispensable to the Eskimo, and incomparably the best garment and blanket for Arctic work. Besides ring seal, a few bearded seal (*Phoca barbata*) are killed in Cumberland Gulf. These, a large seal weighing 500 to 700 lbs., are invaluable for making and resoling boots, being tough and waterproof. I estimate the number of seals of all kinds killed yearly in Cumberland Gulf at 5000 to 6000, and the supply does not appear to be affected, as this has been going on for many years.

From Resolution Island to the entrance to Cumberland Gulf (though not far up the gulf itself) on the south side, there are large herds of walrus generally to be found in the deep indentations of the coast; these are very little hunted now. Of all the Arctic Sea foods the walrus stands first. His blubber and meat are more palatable, his great size supplies food for natives and dogs alike, and his hide, with some blubber left on, is the best of dog food for winter travel. Not being worth hunting now for

their hides as an article of commerce, the walrus are increasing rapidly on the Baffin Island coast.

In the spring or early summer another source of food supply to the natives is the white whale, which is found in large numbers in Frobisher Inlet and Cumberland Gulf. At this season the meat soon becomes high, and is usually put under piles of stones for dog food in winter, though the natives frequently use it themselves. The white-whale hides have a fair commercial value, and the Hudson Bay Company obtain considerable numbers of them.

On the coast of Baffin Island, north from Leopold Island at the north entrance to Cumberland Gulf, a few natives are scattered between this island and Cape Kater north of Home Bay, and walrus and seal are numerous as far as Kater. This coast would support a much greater population—has, in fact, done so within man's memory, for till the last decade the natives have been disappearing rapidly; a slight improvement seems now to have taken place.

I believe that all the non-glacial rivers of Baffin Island supply large quantities of salmon, which run in September, and can be then taken and frozen for winter use. Nets are useful but not necessary, the salmon being taken in pens made by placing rocks across the river at a suitably shallow place.

The Home Bay natives get their cariboo inland, where they say they often see large herds, probably of the Lake Nettilling migration. They report a large lake between Piling on the Fox Channel and the north-west corner of Home Bay, and the distance across from tide water to Piling is spoken of as indicating only 60 to 70 miles.

There are no permanent settlements now along the Baffin Island coast from Home Bay to Ponds Inlet, though in the 'seventies and 'eighties Clyde River, Eglinton, and Dexterity all had permanent camps. The cessation of the whaling industry compelled these people to move north or south, where they could obtain supplies of ammunition and rifles. Seals are numerous along the whole east coast of Baffin Island, but are difficult to get in winter between Kater and Ponds Inlet in certain seasons if the ice presses heavily in on the coast. For this reason the natives do not care to make this journey before April; by this date they can obtain plenty of seals anywhere along the coast.

Polar bear are very numerous along the Baffin Island coast, and form an important item in the food supply and trade of the natives after February; bear do not appear to be decreasing in numbers. Though salmon do not run up rivers having their source in glaciers, off the mouth of these rivers and streams they are often taken in August; they appear to leave the lake in which they have wintered as soon as the ice permits, travelling varying distances along the coast and congregating at the mouths of any streams. In September—depending on the season, whether late or early—the salmon return to their "home" river, and are

then in the best condition. Their principal food appears to be sea lice, and they become in fair condition within a week or ten days of reaching salt water.

Usually, when parties leave for the summer deer hunting, the old people and some of the children stay at the tide water at the mouth of a good salmon river, and put all the fish they take under piles of rocks. The earlier caught become very soft and rotten, and are used in winter as dog feed, though the natives enjoy a feed of this "for a change," just as they do rotten walrus or seal meat, which in white nostrils smells to high heaven.

The natives of Ponds Inlet (the Tununirohurmuit)—which includes all Eclipse Sound—are fine seal hunters, and depend on these for their winter food. Occasionally the seal fail at certain settlements, as happened in 1920–21, when I was compelled to feed about eighty natives at our station for nearly three months, the seal failure coinciding with a failure of the deer hunters to obtain winter clothing; consequently the women and children could not be moved to better sealing grounds.

While on this subject I would urge on the Canadian Government the vital importance of controlling the export of cariboo skins from the Canadian Arctic, permitting only the moving of them within the Arctic itself, to enable one part of the country to supply another. The importance of these skins for winter clothing cannot be too strongly emphasized, and to lack of it can be traced a considerable mortality amongst the Eskimo as a first cause of lung affection or bronchial sickness. No white man's clothing is even a tolerable substitute for these admirable skins.

The cariboo of Baffin Island appear to be divided into two major herds, with several smaller herds which are local in their range. The northern of these two large herds range from the shores of Eclipse Sound and Lancaster Sound as far south as Piling on the north-east end of Fox Channel. The southern herd—which certainly mixes considerably with the northern—ranges from Piling south to the islands on Lake Nettilling. This southern herd sometimes winters on the highlands north of Cumberland Gulf. There are local herds on the land between Frobisher Bay and Cumberland Gulf, and also on Melville and Brodeur peninsulas. Cariboo are also found in summer a few days' journey from tidewater at the head of several of the deep and as yet quite uncharted fjords on the east coast; these are probably offshoots of the two large herds.

For some years an important source of food supply to the Ponds Inlet and Admiralty Inlet natives is furnished by the narwhal, and since I have made and encouraged the building of kyaks, some of these whales are always taken in summer and autumn. Occasionally large herds of narwhal are caught in Eclipse Sound by the early setting of the ice in the Navy Board and Ponds Inlet, and then the winter larders of the natives are full indeed. It is probable that very large herds of narwhal are sometimes

wiped out completely by this cause. In 1917–18 the natives killed some 500 or 600 at blow-holes; these were, they said, only a few of the large number they believed were subsequently drowned by the closing of the ice. The sinew of the narwhal and white whale is a valuable thread for certain kinds of work, such as kyak sewing; cariboo sinew and the very excellent sinew from the throat of the bear being other kinds of thread used for foot wear and clothing.

At the north end of Fox Channel are the Igluliut tribe of Eskimo. In Parry's time these were a large tribe (1820–21). They are now very mixed with the Ponds Inlet and Admiralty natives, and it is certain they have intermarried with these for a very long period, sometimes by arrangement, sometimes by "Sabine" rapes on a considerable scale. About the 'forties, owing to the fear of the Igluliuts, the whole population of Admiralty Inlet disappeared, and this may coincide with the arrival of a party of Eskimo at Etah in North Greenland some years later, as recorded by Rasmussen.

The Igluliuts are the best walrus hunters in the Arctic, excepting only the Etah Eskimo. Their winter hunting grounds range from Amitoke on the west to Piling on the north-east of Fox Channel, and these seem to be unfailing walrus grounds. I have never heard of a story of starvation amongst the Igluliuts, though such tales are too frequent with every other tribe I have heard of, except the Cumberland Gulf natives. As lately as 1919–20 a number of Nechilling natives died of starvation in the Repulse Bay country, according to Igluliut report.

Any intelligent Baffin Island natives I have talked to agree that a regular supply of ammunition explains the absence of starvation and consequent increase in births over deaths of late years. Against this they agree that rifles and ammunition also explain the depletion of the cariboo herds.

The Igluliuts are the only natives of Baffin Island who hunt the walrus in the old style in winter; they go out on the young ice constantly forming and being broken up by gales, and harpoon the walrus when he breaks through to blow, holding him by driving their lance through the ice at an angle and taking a turn round the base. They pride themselves on killing walrus without a rifle; last winter my trader saw a sixteen-year-old boy take his first walrus unaided in this manner. A frequent cause of death used to be the loss of good hunters by the sudden breaking up of the young ice in a gale; small boats, strong enough to be put on the sleds and loaded with meat are now taken by them to the walrus hunt. As before noted, and prompted by what I have observed in Greenland, I have encouraged the natives of Ponds Inlet to use the kyak, this eminently suitable canoe being invaluable for procuring seal and small whales in summer.

For the Ponds Inlet and Admiralty natives, the most important sealing period is between November and March, and it is then they need to be

camped at a good sealing ground. Seals are obtained then (except in a few places) entirely by the waiting method not quite accurately described by Stefansson in his 'Friendly Arctic.' Only a very exceptional white man could stand the cold long enough to hunt often by this method, or would possess the skill to kill his seal when it comes to the breathing hole. Were Stefansson to make a long coastal journey with white men only along Baffin Island, I should doubt his ability to provide food for his party and his dogs by the waiting method of sealing, the only one by which seals can be obtained round this coast during winter, within reasonable distance of land. Food, first and foremost, is the Baffin Island Eskimo's main interest, and he will invariably reply to your question as to a good winter or otherwise in terms of food, *i.e.* a hungry or not hungry winter. It will be a misfortune if these people are to be exploited by big companies, and the native encouraged to trap fur to the detriment of his hunting, and to purchase much trade goods useless to his simple mode of life. Though it is perhaps impossible of realization owing to vested interests, and the difficulties of administration, the suggestion in the late Gordon Hewitt's book 'Wild Life in Canada' that the north-land should be administered as a Crown monopoly, is a sound one. We have only to contrast Greenland's twelve thousand inhabitants, all healthy, happy, and self-supporting, with the vanishing Eskimo of the Canadian Arctic, having far greater economic resources in its waters, to realize the truth of this statement.

STEREOGRAPHIC SURVEY: THE STEREOAUTOGRAPH

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Read at the Afternoon Meeting of the Society, 13 *February* 1922.

IN the spring of 1921 M. Emmanuel de Margerie, on a visit to London, gave a very favourable account of the results obtained with the "Stereoautograph" of Von Orel and Zeiss in the survey of the Grande Combe, a hilly wooded coal-mining region in the south of France, near Nîmes. This survey had been undertaken by the *Société française de Stéréotopographie*, a company formed in Paris by M. Paul Corbin, with Colonel Talon, formerly of the *Service géographique*, as Director, and Commandant Vavon of the same service as technical chief.

The question arose, whether the method was applicable to the survey of Mount Everest; and I was directed by the President of the Royal Geographical Society to study the methods and apparatus.

Having learned from Colonel Talon that he would very gladly give me every facility, I left for Paris on the evening of 6 April 1921, and spent the greater part of the following eight days in examining the installation at the offices of the Société in the Rue Lauriston, No. 85,

and in studying the geometrical theory. A pretty full description of the general features of the apparatus, and a slight account of the theory, have been published by M. Corbin in the *Revue générale des Sciences pures et appliquées* for 30 March 1914, and to this I will refer for the mechanical details, remarking only that the instrument there figured is the model of 1911, and that some considerable improvements have been introduced into the model of 1914 which is now in use at Paris. The more important will be described in this report.

Brief History of the Method.

It is unnecessary to discuss the methods of Phototopography developed by Laussedat in France and by Deville in Canada, which depend on the measurement of identical points on pairs of plates taken on determined azimuths at trigonometrical points. The radical defect of this method is in the difficulty of identifying corresponding images of the two plates. This difficulty was removed by the invention of the stereocomparator of Pulfrich about 1903. When a pair of plates taken on parallel axes is viewed in the stereocomparator, the ground is seen in relief, and the identification of the most minute detail visible on the photographs becomes automatic; there is no longer any possibility of mistakes from misidentification.

The first application of the stereocomparator to topography seems to have been made at the Austrian Military-geographical Institute by General von Hubl about 1904. From the varying parallactic displacement of points at different distances, as measured on the stereocomparator, it was possible to calculate the distances, and from the coordinates of the points on one of the plates to calculate and plot their positions. The method was accurate but tedious.

The next step was taken by Lieut. F. Vivian Thompson, R.E., in the invention of the stereoplotter, described in the *Geographical Journal* for May 1908. The optical apparatus was essentially identical with the stereocomparator of Pulfrich. But an arm geared to the plate carriage gave the direction of the point; a milled head operating the differential slide of the plates gave the distance; a parallel ruler set from the reading of the milled head gave by intersection with the first arm the position of the point, and by intersection with a second arm geared to the vertical slide of the stereocomparator gave the height. With this machine the map was plotted point by point, and the height of each point determined. It is not possible with this instrument to work along a chosen contour exactly, and there are inconveniences in working with bases of varying length, requiring the substitution of scales which must be in general more or less inclined to the parallel ruler whose intersection with them is sought. The instrument was never brought to any great mechanical perfection, and its ingenious inventor was killed in action early in the war.

About the same time that Thompson was working out the details of his method at the S.M.E., Chatham, Lieut. von Orel was developing a similar device at the Vienna Institute, but carried it further, so that the determination of the point became automatic, requiring no setting of scales by hand. He then seems to have sought the assistance of the firm of Carl Zeiss, who on 19 December 1910 patented in Germany, without mention of von Orel's name, the apparatus which was described by Corbin as the model of 1911. The specification of the British patent, applied for 15 December 1911 and granted 26 September 1912, states that the problem has several times been solved in a limited form, and that the oldest solution is that of Thompson given in the *Geographical Journal.* The specification is couched in very general language, and the drawings attached belong to a pattern much more primitive than the model of 1911. The description is confined to the simple case of photographs taken in pairs at right angles to a horizontal base, and the drawings give no indication of the great extension of possibilities realized in the model of 1911 as described by Corbin, that the base need not be horizontal, that the photographs may be inclined to it at any angle up to about 40 degrees, and that their axes need not even be parallel. These improvements are apparently first patented outside Germany in an application made by Carl Zeiss in Austria, 19 December 1913; British application 30 April 1914, accepted 22 July 1915, that is, during the war.

A still later model is patented in Germany, 8 July 1918, and by British application dated 31 May 1920, accepted 3 March 1921, in which the limitation to horizontal axes is removed. This specification is couched in still more general terms, defined by a complicated trigonometrical formula, and five different constructions are mentioned, but there is no word of the obvious application, that the map can be plotted from pairs of air-photographs. I learned from Commandant Vavon that such a machine was in contemplation, but do not know how far it is in successful operation.

In what follows, then, I shall describe the model known as that of 1914, which in its geometry is very similar to that described by Corbin as the model of 1911.

The photo-theodolite is that described by M. Corbin as the model of 1913. It does not differ in principle from much earlier instruments, such as the well-known Bridges-Lee instrument.

The Stereoautograph.

The geometrical theory of the instrument is reserved for treatment later. It will suffice for the present to say that the apparatus consists of a system of levers actuated by three hand wheels, which we will call the distance wheel, the direction wheel, and the height wheel. This system is coupled on the one hand to the slides of a Pulfrich stereocomparator,

and on the other to the drawing pencil which moves over the drawing board. The height wheel is supplemented by a pedal, as it is termed —but more accurately a horizontal disc operated by the foot—which operates the same system. It is thus possible to make the three movements simultaneously. A second foot-disc operates the vertical displacement of the right-hand photograph with respect to the left.

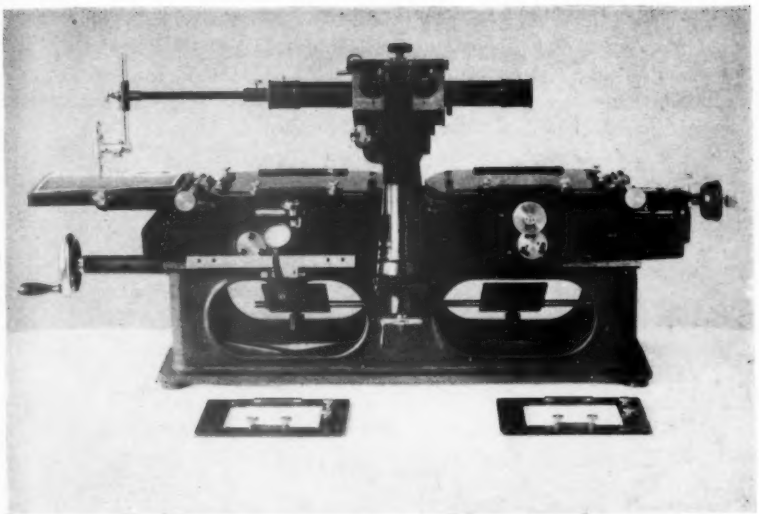
The direction wheel moves both plates together on the principal slide of the stereocomparator; the distance wheel moves the right-hand plate horizontally with respect to the left-hand plate, with the effect that the mark in the stereocomparator appears to advance or recede with reference to the landscape; the height wheel moves the plates together on the vertical slide of the comparator, or more accurately, moves the optical system of the stereocomparator in the vertical direction over the plates, so that the mark appears to move up and down in the field of view, and can by the combined movement of the three wheels be brought into apparent contact with any point of the ground.

In tracing the horizontal plan all three wheels are operated simultaneously; the mark is made to follow the road or river or outline of building; the pencil draws the plan automatically; and a second operator stands over the drawing board to see that all is going well, and to write in any conventional signs that are needed.

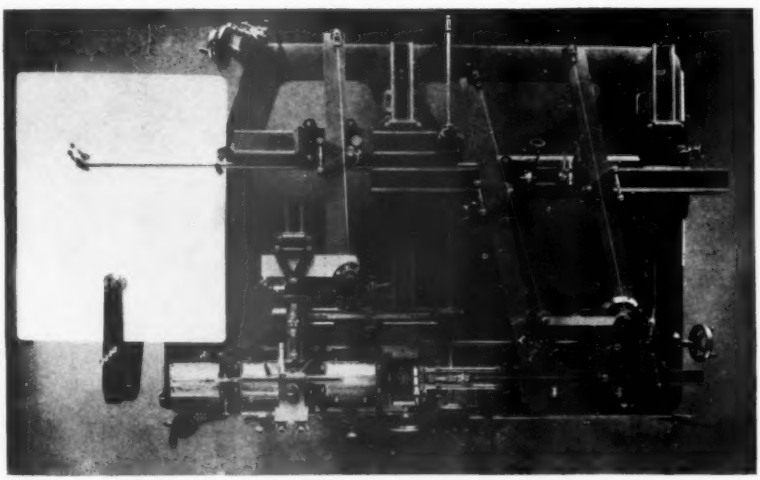
In contouring, the height wheel is set so that the corresponding scale reads the interval of the contour above or below the known height of the left-hand station, the interval being corrected when necessary for refraction and curvature of the Earth; the direction and distance hand-wheels are operated to make the mark move in contact with the image in relief, and the contour is drawn automatically.

Before starting to plot from a pair of photographs a graticule is drawn on the paper (mounted as a plane-table is mounted), and the position of the left-hand station of the base and of two trigonometrically determined control points in the field are plotted. The base station is brought under a fiducial mark, about which the paper can be rotated; the mark in the stereocomparator is set on one of the control points; and the paper rotated until the plotted point comes under the pencil. The second control point gives a check. The heights of the control points are also measured on the height scale, and compared with the known trig. heights. The plotting does not begin until the positions and heights of the control points are reproduced by the apparatus with the required precision. I was not able to see the actual adjustment of a sheet at the beginning of the operation; but I was assured by Commandant Vavon that with experience it is not difficult to discriminate between the different sources of error if the control points do not come right.

I was, however, able to see that a skilled operator can reproduce his results with remarkable accuracy. The operator would specify the corner of a house on which he was going to repeat the setting, and the pencil

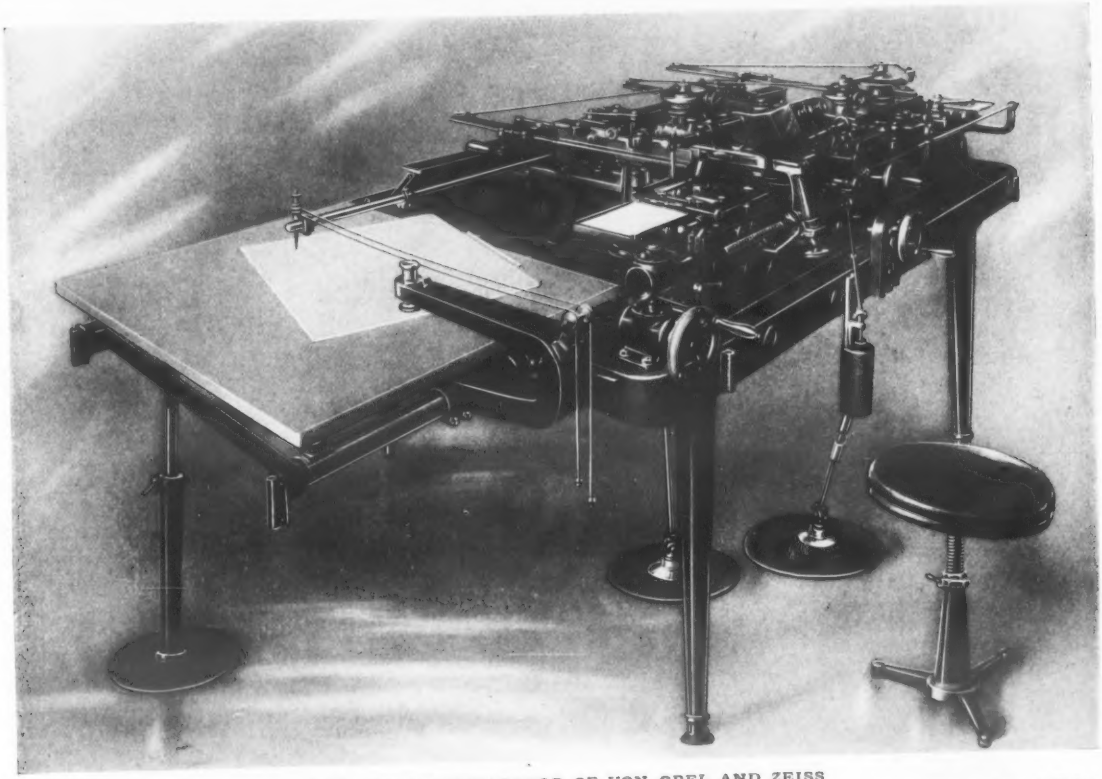


THE STEREOCOMPARATOR OF PULFRICH



THE STEREOAUTOGRAPH OF VON OREL AND ZEISS

By courtesy of Colonel Talon.



THE STEREOCOMPARATOR OF VON OREL AND ZEISS

By courtesy of Colonel Talon.

By courtesy of Colonel Talon.

would come down again upon that point without any visible error, though the first setting may have been made hours before. Similarly he would repeat a contour without any appreciable deviation, and though he doubtless selected the better-defined points and the easier contours for his demonstration, I do not see how the repetition can be other than a very searching test of the method. I therefore formed the conclusion that it is fair to claim for the instrument an accuracy essentially equal to the least visible error of plotting, and am able to accept Commandant Vavon's assurance that the more one works with the instrument, the more one is astonished at its accuracy.

In hilly country such as that of the Grande Combe, the French reckon to cover from three-quarters to four-fifths of the ground by the photographs, and to fill in the dead ground by the plane-table. This is more economical than multiplying the number of pairs of photographs. The method is to plot on the stereoautograph a number of points round the margin of the dead ground, and to send this plot into the field for completion. The detail and contours of the dead ground are thus interpolated on the plane-table, and are found to fit extremely well. I naturally asked what was the result if one surveyed the dead ground independently from the trig. points, without using the detail supplied by the stereoautograph, and learned that the agreement was then not quite so good, but that the want of perfect agreement might with more justice be attributed to the errors of the plane-tabling than to the photographic survey; and I see no good reason to doubt this.

Scope of the Method.

The method of stereographic survey is pre-eminently adapted to the detailed mapping and contouring of steep and broken country on a large scale: say 1/1000 to 1/10,000, for the location of engineering works. The examples given by M. Corbin (*loc. cit.*) include a large open mine on a steep hillside (1/1000); a cliff face at Fiume (1/1000); a high Alpine table basin (1/5000); a piece of the Mont Blanc massif (1/20,000). It is said that the survey for the approaches to the Taurus tunnels was made by this instrument. The French company are mapping a large area in the coalfield of the Grande Combe on 1/10,000.

I have not come across any example of a survey on smaller scale than 1/20,000, except the map of a small area south of Keswick made by Lieut. F. V. Thompson in 1907 with his stereoplotter on 1/63,360. It would seem that the smaller the scale, the greater the difficulty in finding stations to command a correspondingly large area, with room for a sufficient base. The base conditions, however, are not exacting, since the ends need not be at the same height; the plates need not be taken parallel to it, nor even to one another; and the length of the base is conveniently measured by the stadia bar and the micrometer screw of the photo-theodolite, mentioned below.

The photo-theodolite and subsidiary apparatus are heavy, and the present pattern perhaps not convenient for work at great altitudes. One must remember, however, that the apparatus now in use has all been designed for large-scale work of high precision. How far it should be modified for small scales and reconnaissance conditions deserves consideration and experiment.

Applicability to the Survey of the Mount Everest Region.

It appears to me that the stereographic method is especially adapted to the survey of the Kama valley or to the West Rongbuk district: both wide open valleys where stations on the flanks command extensive views. It is probably less suitable for use on a complicated plateau like that around the upper Kharta valley, where there is much dead ground from any point of view. Major Wheeler found it sufficiently hard to get photographs from single stations, in the bad weather prevailing after the end of June: to get pairs of photographs at ends of a measured base would have been much harder, and he would not have completed so many stations. On the other hand, one pair of photographs from each of two stations, north-east and north-west of the mountain, would give a map of the mountain in detail which could not be achieved by any other method. The north face of the mountain could be mapped on the scale 1/10,000 with contour interval of 25 feet, if so sumptuous a map were desired.

For any ordinary use this would be unnecessary. But there is an aspect of the question of mapping which has never, I think, been properly examined. It is the duty of geographers to-day to lay up material for the future solution of the problem: how fast are the processes of denudation? Are tectonic changes measurable in one hundred years? No maps of the present day will be much use in settling such questions: they are not accurate enough in detail. But they might be made good enough by use of stereographic survey. I would like to make now a minutely accurate contoured map of the great razor-edge of Chomo Lönzo, of the marvellously steep walls of the great cirque below the north-east arête, and of many other fine pieces of the world where natural processes seem to be working at a great rate. To make these maps is a duty to posterity. And the reward might come as quickly as it has come to the astronomers who photographed spiral nebulæ not forty years ago.

A more immediate profit could be drawn from the stereographic survey of glaciers: peculiarly difficult to survey on the ground, but very easy from the neighbouring slopes. We must have a good knowledge of glacier-variation before we can hope to deal successfully with many of the larger questions of climate, for the glacier represents a convenient integration of effects whose relative significance cannot be studied by the

ordinary uninspired methods of meteorology. I look forward to the time when systematic and periodic glacier survey will be reckoned among the more important of the scientific services of Government.

Conditions of Sale and Use of the Orel Stereoautograph.

The conditions of sale of this instrument are peculiar and demand careful examination.

First, the instrument is priced in marks which are converted into Swiss francs at the pre-war rate of exchange, and any buyer outside Germany has to pay in Swiss francs: a condition not likely to encourage foreign buyers.

Secondly, the instrument is not put on the market like an ordinary survey instrument which the buyer may use as he pleases. The policy of the makers is to grant a licence for the sole use of the apparatus in any one country, the licensee paying a heavy royalty on the gross receipts of his establishment. This method of exploitation has disagreeable features: it seems to preclude the use of the apparatus except in commercial work for profit. Happily patents do not run for ever. Nor need we believe too readily that the elegant geometry of Von Orel and the beautiful workmanship of Zeiss are not to be beaten. Indeed, the remarkable simplicity of the geometry invites the attention of inventors.

Geometrical Theory of the Stereoautograph.

Though the stereoautograph as made by Zeiss is very complicated, and the action of its inter-connected levers difficult to follow, the geometry underlying them is really very simple, and may some day be realized in a simpler way.

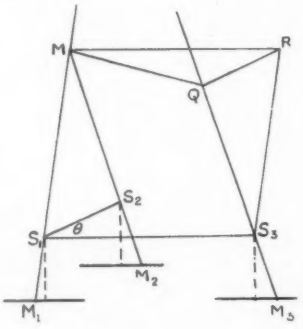


Fig. 1.

In the figure S_1 and S_2 are projections on the horizontal of the two stations at which the photographs are taken (S_1S_2 being called the base), and M is the point to be fixed, which is projected on the two photographs at M_1 and M_2. The photographs are in parallel vertical planes inclined at an angle θ to the base.

Transfer the plate with optical centre S_2 to S_3, so that it lies in the plane

of the first plate, the distance S_1S_3 being arbitrary. Draw S_3R parallel to M_1S_1M; MR parallel to S_1S_3; M_2S_3Q parallel to M_2S_2M; and RQ parallel to S_1S_2. Join MQ.

The triangles MS_1S_2, S_3RQ are equal, since their sides are parallel, and $S_1M = RS_3$. Hence $QR = S_1S_2$ and $QRM = \theta$, the inclination of plates to base.

Hence the triangle QRM has its side QR = the base: angle $QKM = \theta$; and side RM equal and parallel to S_1S_3: that is, its size and shape and orientation are independent of the position of M.

If then in the above figure we had given only the points S_1, S_3, and M_1, M_3, we could find the position of M by applying the invariable triangle to M_1S_1 and M_3S_3 produced, so that M and Q lie respectively on these rays, and MR is parallel to S_1S_3.

This is the simple geometrical principle underlying the action of the stereoautograph.

Mechanical Construction: The Stereocomparator.

The optical parts are simply the well-known Stereocomparator of Pulfrich. The two plates (numbered 1 and 3 to correspond with the geometrical figure above) are on a carriage moved horizontally by the hand-wheel labelled Direction, along the line S_1S_2. Plate 3 has an independent movement relative to plate 1, along the same line, on an upper carriage.

The plates are viewed by two compound microscopes whose objectives O_1 and O_2 are at fixed distance apart S_1S_3, and whose eyepieces E_1, E_2, receive the light from O_1, O_2 through three reflecting prisms in each microscope.

The odd number of reversals by reflexion, combined with the normal inversion of the field in the microscope, give an image of each plate right way up but reversed right and left; if then the negatives are inserted film upwards (*i.e.* reversed R. and L.) the resulting view is correct, except that it is a negative, black for white.

Under the eyepieces are the pointers, and the plates are adjusted in their carriers so that the images of the fiducial marks fall simultaneously upon them. Plate 3 has an additional independent movement at right angles to S_1S_3.

The whole optical system can be moved parallel to the plane of the plates along the line GH perpendicular to S_1S_3. Thus by moving the plates under the microscopes in the horizontal sense, and by moving the microscopes over the plates in the vertical sense, the whole plates can be examined.

The Plotting of Horizontal Detail.

Two bars A and B are pivoted about fixed centres, s_1, s_3 so that s_1s_3 is equal and parallel to S_1S_3. A sleeve m_1 through which bar A can slide is linked to the carriage of the two plates, so that m_1 moves with plate 1 along the line S_1S_3. Similarly the sleeve m_3 on bar B is linked to the upper plate carriage on which plate 3 moves relative to plate 1. The line of motion $S_1S_3m_1m_3$ is parallel to s_1s_3 and distant from it f, the focal length of the objective with which the plates are taken.

A bar LL′ can be moved by the hand-wheel marked Distance always parallel to itself. A bar mr of fixed length equal S_1S_3 or s_1s_3 can slide along LL′; it is connected with the bar A by a pivoted double sleeve.

A bar rq is clamped to mr at r, at an adjustable angle $= \theta$, the inclination of the plates to the base on which they were taken. And the length rq is

adjustable, so that rq is the length of the base on the scale of the desired map. A sleeve pivoted to rq at q slides on B.

If now the direction handle is turned to move the plates together under the microscope, m_1 is displaced horizontally in the same direction and by the same amount. The bar A turns about s_1 and pushes mr in the opposite direction along LL′. This carries q with it and turns B about s_3, displacing m_3 by an amount not quite the same as m_1 (unless θ is zero), and consequently displacing plate 3, which is linked to m_3, a little with the upper carriage, relative to plate 1. Note that if the two plates were on independent carriages (as they are in the 1911 model) the result is just the same, except that the whole movement of plate 3, instead of only its differential movement, is transmitted through the train of levers, and this is not quite so good mechanically. Note also that, by

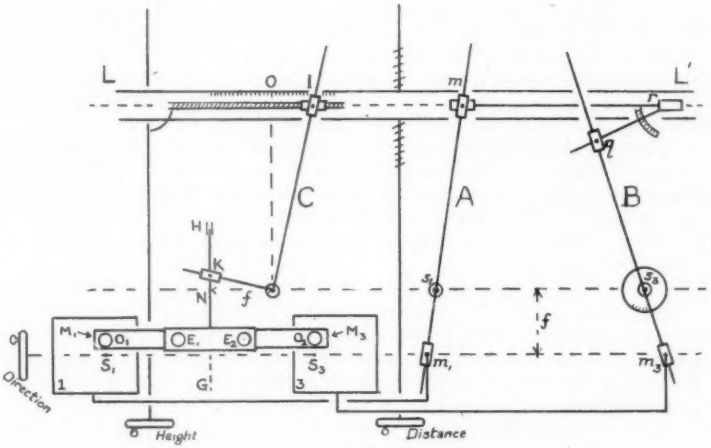


Fig. 2.—Sketch of the principal moving parts.

the similarity of Figs. 1 and 2, the differential movement of 3 is exactly right to maintain the setting of the R.H. microscope on the same point as the L.H. if the point is imagined in Fig. 1 to move along the line MR at a fixed distance from S_1S_3. MS_2M_2 is parallel to QS_3M_3, and similarly divided.

Now displace LL′ parallel to itself by the distance hand-wheel. The plate 1 and the bar A remain fixed; mrq slides along LL′, and transmits through B and m_3 a motion to plate 3, relative to 1, with the result that the apparently single pointer seems to advance or recede in the field of view When the pointer is thus set upon an object in the field, s_1m is its direction and distance on the map from s_1, the station at which plate 1 was taken, and a pencil underneath m will plot on the map the position of M. Thus the horizontal detail is drawn. We may either plot individual points, as corners of houses, or we may make the pointer traverse a road and draw it continuously on the map.

The Plotting of Contours.

So much for the horizontal detail. We have now to consider the question of heights.

The centre of the microscope system moves in the vertical sense along the line GH. A rod attached to the carriage slides in a fixed bearing H and carries a smooth sleeve pivoted to it at K. A rod JK turns about a pillar fixed at J in the line of s_1s_3, distant f from GH, and slides in the sleeve K.

A rod IJ fixed at right angles to JK passes through a sleeve at I jointed to a nut which is traversed along the bar LL′ by a long screw turned by bevel-gear (not shown) from the hand-wheel marked Height, or from a foot-wheel connected with it. A divided scale with zero adjusted so that JO is parallel to GH, measures the displacement of I right or left, corresponding to the displacement KN of the microscopes above or below the optical centres of the plates: that is, to the height coordinate of the point on the plate. But the triangle JOI is similar to JNK; and JO is the distance coordinate of the point on the scale of the map. Hence OI is the height coordinate on the same scale; and if the divided scale is the same as the scale on which the base rq is set, the readings OI will give directly the height of the point M above S_1.

The operation of this system of levers requires a little study. If the height wheel is turned OI is varied, the system IJK rotates about J, and the microscopes are moved in the vertical sense over the plates. This provides for the measurement of all heights in a coordinate plane parallel to the plane of the plates as taken, and distant by an amount corresponding to the distance between LL′ and s_1s_3.

If on the other hand the height wheel is left untouched, OI remains unaltered in length. But if the distance wheel is turned, and LL′ is moved away from Js_1s_3, the rod C slides in the sleeve at I; the angle IJO is decreased, and the microscopes travel downwards over the plates by an amount corresponding precisely to the diminution of vertical coordinate on the plate as a point of given height above the base is removed further from it.

By this elegant construction, therefore, the height of any point in the field above the base point S_1 may be measured on the scale OI. But alternatively, if OI is set to the vertical interval of any desired contour above or below S_1,* and the height wheel is left untouched, the pointer can, by moving the direction and distance wheels, be brought into contact successively with all points on the contour, and it describes the contour. This is the particular merit of the machine, that it can describe contours. Moreover, if a point from plate 1 is adjusted on a table to the left of the plate, a tracing arm carried on the microscope will trace on the print the contours in perspective: a remarkably simple and sometimes valuable property.

We have spoken of the map as traced by a point below m. This requires a drawing inaccessibly placed under the machine. In the later models a stiff bar is rigidly attached below LL′ and extended to the left, to carry a pencil over a drawing board quite clear of the machine.

One more beautiful property must be mentioned. If the plates 1 and 2 are not parallel when they are taken at S_1 and S_2, but their axes converge somewhat, they will still exhibit a relief when examined in the stereocomparator

* When the distances are great a correction of the setting must be made to allow for curvature and refraction: a single correction is generally sufficient, unless the contour which is being traced has great depth in the field.

though the perspective will be false. To make a map from such a pair of plates it is necessary only to cut the arm B in such a way that its two parts qs_3 and s_3m_3 can be clamped at an angle equal to the angle between the planes of the two plates when they were taken. But the proof of this remarkable though very simple theorem must be left to the reader.

Range of Action of the Instrument.

The stereoscopic relief is satisfactory when the relative displacement of the images is between 10 and 30 mm. The length of base must be chosen accordingly. For example, if it is desired to work to a maximum distance 15 km. and the focal length of the photo-theodolite is 200 mm., the length of the base is given by

$$\text{base} = \frac{\text{min. displ.} \times \text{max. dist.}}{\text{focal length}} = \frac{10 \cdot 10^{-3} \times 15 \cdot 10^{3}}{200 \cdot 10^{-3}} = 750 \text{ m.}$$

and with this base a displacement of 30 mm. will be reached for points 5 km. away. Hence with base 750 m. the limits of distance for good results are 15 km. and 5 km. It is easy to construct a diagram to show the length of base required in any given conditions.

At a given pair of stations making one base, it is usual to take three pairs of plates, respectively parallel to and inclined 30° either way to the base. But we have seen that there is no real necessity for the pairs to be parallel to one another, and this gives liberty to use the machine on pairs of plates taken for photographic survey but not intended originally for the stereoscopic method.

The positions of the camera stations, and of at least two control points in each field, must be fixed and referred to the main triangulation. The calculated coordinates of these points, plotted on the board, permit the adjustment of the board on the machine.

The machine is operated by two persons. One sits at the stereocomparator and manipulates the hand and foot wheels. The second stands over the drawing board to see that the point is actually tracing, and inserts the necessary conventional signs, figures of contours, etc.

Although the moving parts must weigh many hundreds of pounds, the movement is very smooth and easy, so that settings are made with all the precision of a micrometer. Friction is relieved everywhere by ball or roller bearings, and a very high degree of optical and mechanical accuracy has been achieved.

The Photo-Theodolite.

The tripod seems to be rather heavy and clumsy, and inferior to the standard British pattern. It has a centering head and upper plate with levelling screws. There is a central sleeve into which the cylindrical base of the camera drops, and can be clamped.

The camera body is of cast aluminium alloy. It works at fixed focus, defined by worked stops whose plane is perpendicular to the optical axis. Here, and generally throughout the construction, there are no adjustments. Everything depends on the original accuracy of workmanship, which is not in accordance with what is generally thought to be the best practice. The vertical and horizontal through the optical centre of the plate are defined by very small holes drilled in the stops, which produce small well-defined circular dots on the edges of the plate. Pierced circular drums revolving almost in contact with the lower edge of the plate record automatically the number of the station and of the plate, and the focal length of the objective.

The objective is fitted with a yellow screen, and with a lens of small power slightly excentric in front, whose rotation provides a means of adjusting the

horizontal collimation. The objective is carried on a rising front with stops working in a series of holes, and the front carries two arms extending backwards to the plane of the plate to mark the position of the horizontal through the optical centre.

A theodolite is mounted on top of the camera, with horizontal circle reading to 50 centesimal seconds, or 16″, by verniers. It can be set by stops to read 0^g, 100^g, or 100 ± 35^g, or can be set to any other angle by the horizontal circle. Vertical angles are read to the same degree of accuracy. The telescope of the theodolite has internal focussing by a third lens, and the horizontal collimation is adjusted by the same device of an excentric lens. There is no adjustment to the horizontal axis for level.

For measuring the length of the base the theodolite can be rotated by a micrometer screw with hemispherical point acting on the hardened flat face of an arm which is fixed to the theodolite. The head of the screw therefore reads tangents of the angle of rotation, and allows direct readings on a stadia rod mounted at the other extremity of the base perpendicular to its length. This is elegant, but since the point of the screw works up and down the surface, it seems to be likely to wear a groove, and I understand that the French do not consider it sound.

There is a figure of the theodolite and camera, with further details, in the description by M. Paul Corbin published in the *Revue des Sciences pures et appliquées*, 30 March 1914.

The plates used are 18 cm. × 13 cm. They are very fine-grained slow plates, orthochromatic on patent plate glass.

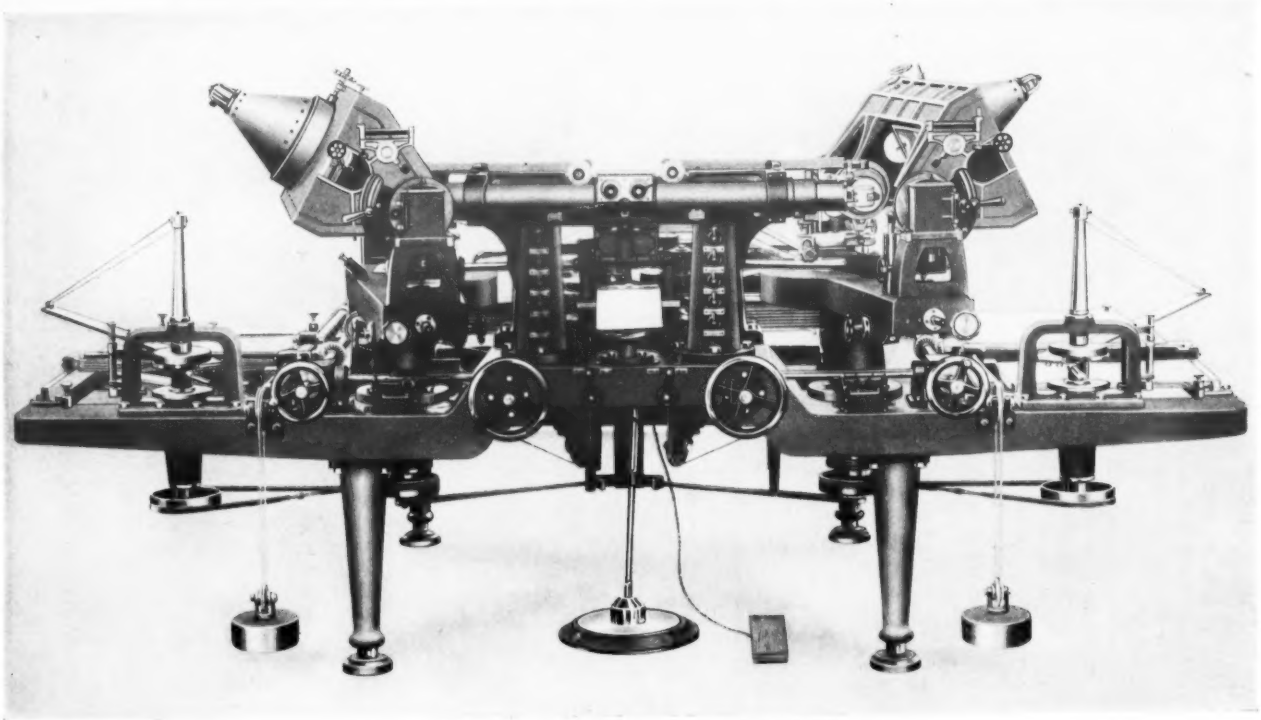
STEREOGRAPHIC SURVEY: THE AUTOCARTOGRAPH

Lieut.-Col. M. N. MacLeod, D.S.O., R.E.

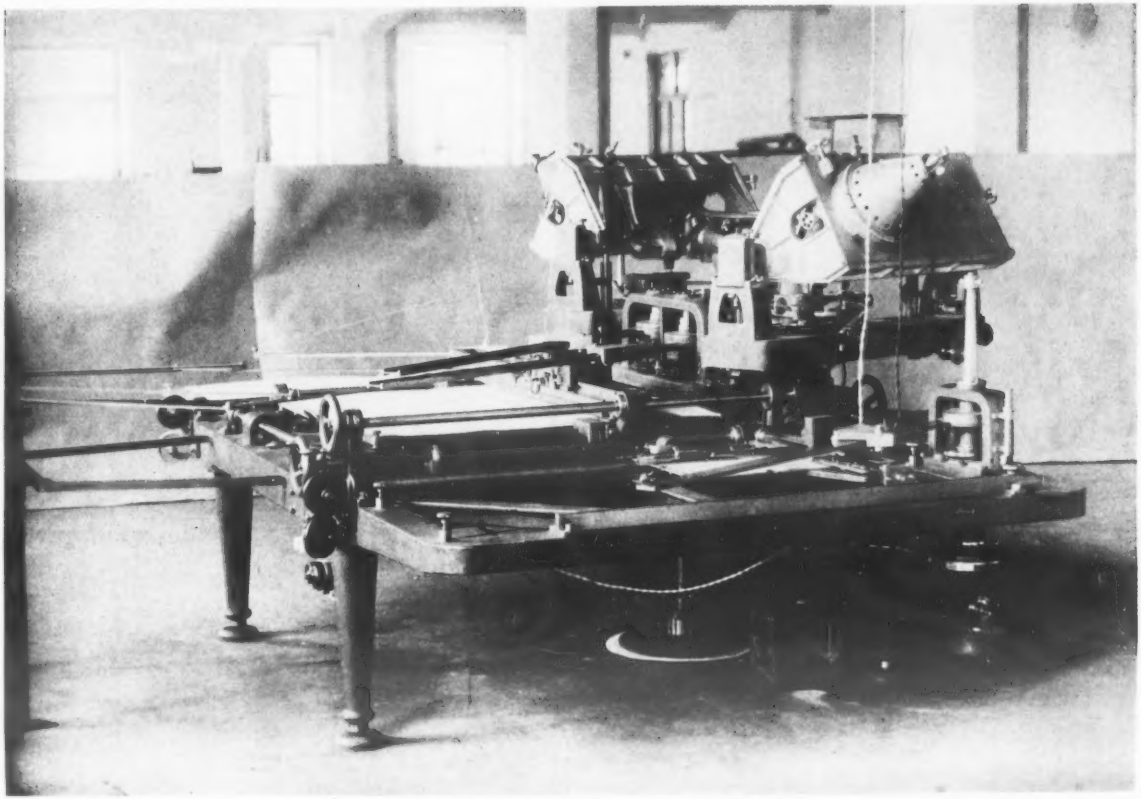
Read with the preceding paper at the Afternoon Meeting of the Society, 13 February 1922.

THE autocartograph is an apparatus designed by Professor R. Hugershoff, Professor of Geodesy at Dresden University, for applying the principles of stereogrammetry to aerial photographs. Until lately this principle has only been used with photographs which are taken exactly parallel and horizontal. Orel's stereoautograph applied it to photographs which are not exactly parallel, but which must be horizontal. Hugershoff claims to advance a step further and apply it to any two photographs which are sufficiently parallel to give the stereoscopic effect of relief. The autocartograph is designed to correct automatically both for non-parallelism and for tilt.

This is effected by the employment of an instrument called by the Germans a "Bildmesstheodolit." It will be advisable therefore to give a brief description of this instrument as a preliminary to that of the autocartograph itself. The Bildmesstheodolit, in its original form, consists of a telescope of low power mounted so as to rotate about two axes, one



THE AUTOCARTOGRAPH OF HUGERSHOFF



THE AUTOCARTOGRAPH OF HUGERSHOFF

horizontal, the other vertical, whose intersection is in front of the object glass and coincides with the centre of rotation of a holder for the photograph.

This holder consists of a metal casting, with balance weights, and may be regarded as the aerial camera placed in front of the telescope so that the latter can look into it backwards through the lens. The holder rotates about the same horizontal axis as the telescope and carries a lens, identical with that used in the aerial camera, fixed so that its principal points coincide with the intersection of the telescope axes. It is provided with a special plate carrier which enables the plate to be rotated in its own plane about its centre or any other adjacent point.

An oblique aerial photograph can be placed in such an instrument, and can be looked at, through the telescope, so as to give a view virtually the same as that which would be obtained through a theodolite set up and levelled at the point from which the photograph was taken. It is only necessary to rotate the photograph in its carrier until the axis of tilt is horizontal and to tilt the holder to the same extent as the aerial camera. Vertical and horizontal angles to any point visible on the photograph can then be read off directly on arcs provided for the purpose.

This principle is used in the autocartograph to correct for non-parallelism and tilt of the photographs used. Each photograph is viewed through a Bildmesstheodolit of special design, of which the plates and plate-holders must be set in positions determined by a preliminary calculation.

This preliminary calculation involves the determination of:

(i.) The spatial coordinates of the two view-points.

(ii.) The direction of the optical axis of each photograph in a vertical plane.

(iii.) The direction of the optical axis of each photograph in a horizontal plane.

(iv.) The direction on each photograph of the axis of tilt.

(v.) The basal angles of the triangle formed by the two view-points and one previously fixed point in the landscape.

(vi.) The distance apart of the two view-points.

Determination of these elements is effected by a "resection" in space from three or more points, which have been previously fixed by independent methods, and which appear on the photographs. The photographs must be taken so that a certain area of previously surveyed ground appears on them, preferably in the foreground.

The camera used for taking the photographs is a hand-held camera of special construction, noteworthy, however, only in respect to the arrangements provided for ensuring that the plate is accurately in the focal plane when exposed, for the refinement in the collimating marks defining the optical axis, and for the type of shutter, which is a "between lens" shutter giving an exposure of about 1/200 sec. The focal distance is accurately

determined after the lens has been fixed in position by comparison with theodolite observations.

The photographs are taken over the side of the aeroplane in a direction roughly at right angles to the line of flight: the height depending on the scale of the map. For a scale of 1/10,000 Hugershoff gives 1600 metres as a suitable height, 3000 m. for a scale of 1/25,000. The camera is held, by means of a small bubble clinometer, at an angle of approximately 30° to the *horizontal*. The interval between photographs is given as about 1 kilometre.

Photographs taken thus are expected to include in the foreground at least three points whose heights and positions are known. From these the position of the aeroplane at each exposure is deduced.

The computation of this resection in space is a considerable matter. Hugershoff adopts a "trial point" method which he has described in his book, and which, he claims, is the simplest available, and gives an accuracy of ± 1 metre in the resulting position assigned to the view-point, of about ± 30″ in the angle of tilt, and ½° the direction of the axis of tilt. He uses the Bildmesstheodolit for determination of the trial point and for shortening the computation in various ways. For example, when the "trial point" has been found the axis of tilt can be found in a few minutes by trial and error with the Bildmesstheodolit.

Having completed these preliminary calculations, operations are transferred to the autocartograph, which is shown diagrammatically in Figs. 1 and 2. It consists of a binocular stereoscopic telescope with a Bildmess-theodolit placed in front of each object glass.

Owing to obvious mechanical difficulties the telescope cannot be mounted on two axes as in the ordinary Bildmesstheodolit. Instead, the object glass of each telescope is made to rotate in a vertical plane, and the azimuthal movement is given by rotating the photograph holders in a horizontal plane. The axes of rotation intersect in the centre of the lens of the Bildmesstheodolit. The azimuthal movements are transferred mechanically to two arms or levers travelling over a plotting board in front of the operator, and the vertical movements transferred similarly to two height arms or levers, one at each side of the apparatus.

Scales or arcs are provided to indicate the extent of such movements. The horizontal arcs are read by means of a microscope placed below the binocular.

The azimuthal levers are pivoted at the operator's end at an arbitrary distance apart, and are connected to the Bildmesstheodolits by clamps. At their opposite ends they are connected by a distance piece carrying a scale. This distance piece can slide up and down the arms, remaining however in all positions parallel to the line joining the pivots.

The height levers are also pivoted at the operator's end, and pass at their opposite ends through a slide moving along a graduated bridge connected to the distance piece already referred to; by suitably setting

the zero of the scale on the bridge, a pointer on the slide will indicate the height of any object plotted on the plotting board.

Plotting is effected by means of a pencil attached to the distance piece, and raised or lowered by an electrical control from the operator's seat.

This pencil follows the apparent movements of a mark or pointer in the field of view of the binocular. Any feature such as a road or railway visible on the photographs can be drawn in quite automatically, while the height of any point can be read off on the scales over which the height levers travel.

If it is desired to draw in a contour the height levers are clamped to the scales at the particular height required. The operator then moves the pointer in the field of view so as to keep it in apparent coincidence with the surface of the ground. The pencil will then trace out a contour line of the required height.

Other attachments to the apparatus, which I need not describe, are provided for drawing profiles or sections of the ground along any particular line—say a road or railway—and also for redrawing an ordinary map in two ways so that when the drawings so obtained are viewed in a stereoscope the contour-lines appear in stereoscopic relief like a cardboard relief map.

The following is the method of setting or adjusting the instrument after the preliminary calculations are complete:—

(i.) The photographs (glass positives) are placed in the holders with their axes of tilt horizontal.

(ii.) The holders are inclined and clamped at the calculated angles of tilt.

(iii.) The azimuthal levers are set at angles with the line joining their pivots corresponding to the basal angles of the triangles formed by one fixed and the two view points.

(iv.) Keeping the arms at this angle, the distance piece is moved until a pointer on the right-hand slide reads on the scale a distance equal to the stereoscopic base (*i.e.* between the two view-points at the required scale). The slides and distance piece are then clamped together.

(v.) The Bildmesstheodolits, not yet attached to the horizontal or vertical arms, are rotated until the stereoscopic view is obtained, and the pointer appearing in the field of view is "laid" on the fixed point both as regards direction and depth. In this position they are clamped to the horizontal arms.

(vi.) The vertical arms and the zero of the height scales are adjusted so that the height reading of the point is correct, and the height lever pivots are then clamped.

(vii.) The pencil can now be lowered and follows the apparent movements of the pointer in the field of view.

This pointer is really a mark in the centre of the focal plane of each

eyepiece. The eyes combine these two marks to form a single image, which is at infinity when the optical axes, or central lines of sight, of each photograph are parallel.

Revolving one photograph relatively to the other causes this image to appear to advance. This movement is given by a wheel worked by the operator's right hand. This screws the distance piece in or out, thus altering the relative orientation of the two photograph holders. Apparent lateral movement of the pointer is given by a wheel worked by the operator's left hand. This moves the distance piece from side to side, and with it both plate holders. There remains finally the vertical movement, which is given by a plate suspended below the apparatus and revolved by the feet. These movements proceed with reasonable, if not with remarkable, smoothness.

The time-table of work given by Professor Hugershoff for a pair of photographs is: one day for photography, two days for the preliminary computations, and one day for plotting.

The area covered by a pair of photographs is said to be about 30 square kilometres.

Having no experience of the practical working of the instrument, I will not venture to criticize these figures beyond giving my impression that the use of a 13 × 18 cm. plate in conjunction with a lens of only 16·5 cm. focal length seems to be expecting rather too much in the way of definition from the lens.

As regards the theory I would make the following comments:

(1) The method of resecting in space by means of a "pyramid" of comparatively small apex angle appears to be rather weak.

This, coupled with the fact that the photograph viewed through the Bildmesstheodolit looks distinctly "woolly," makes me think that the "probable error" claimed for such resections does not err on the side of caution.

(2) The stereoscopic method requires exceptionally good definition in the photographs. The area to be mapped lies in the background of the photograph, and it is doubtful if the definition and contrast of a distance landscape will be really satisfactory unless the features are very prominent. I personally found it most difficult to judge the apparent coincidence of the pointer with any but the most prominent landmarks on the photographs exhibited. Admittedly I was a novice. No doubt also I lacked in some degree the gift of seeing relief in a stereoscope.

(3) The most serious objection, however, seems to me to lie in the use of the stereoscopic principle at all for *accurate* aerial work. The *ground* surveyor only uses this principle when circumstances compel him to use a short *base* for fixing distant points. He uses it only when his stations of observation lie on mountain-tops which are difficult to climb. He cannot climb more than a few without unduly prolonging the time and labour required for his work, and having got to the top of each he wishes to

Simplified Diagram of the AUTOCARTOGRAPH.

FIG. 1. Plan.

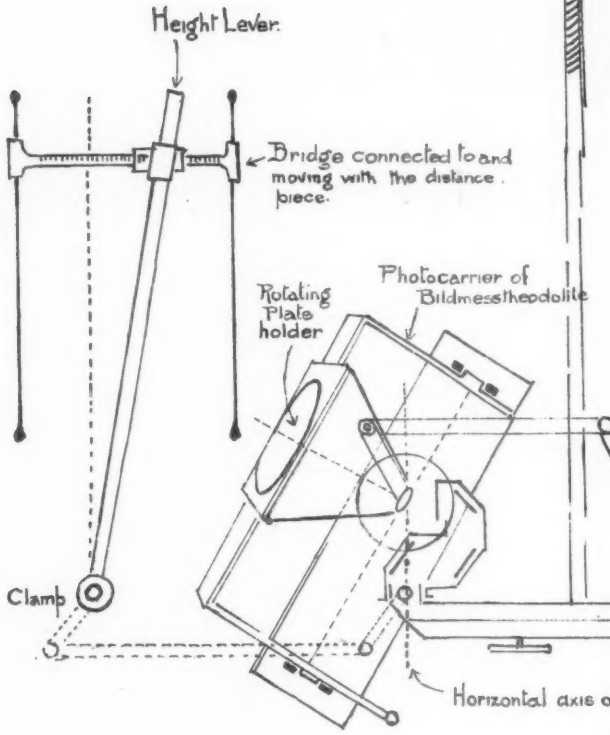
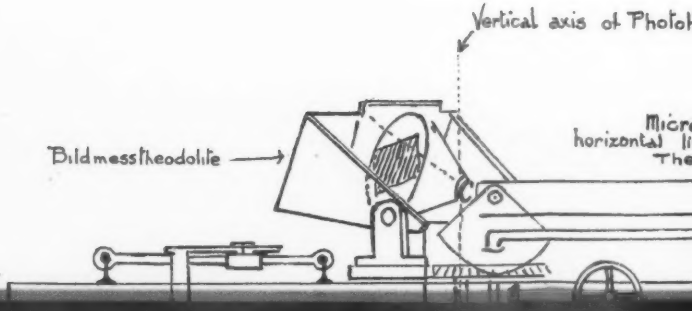
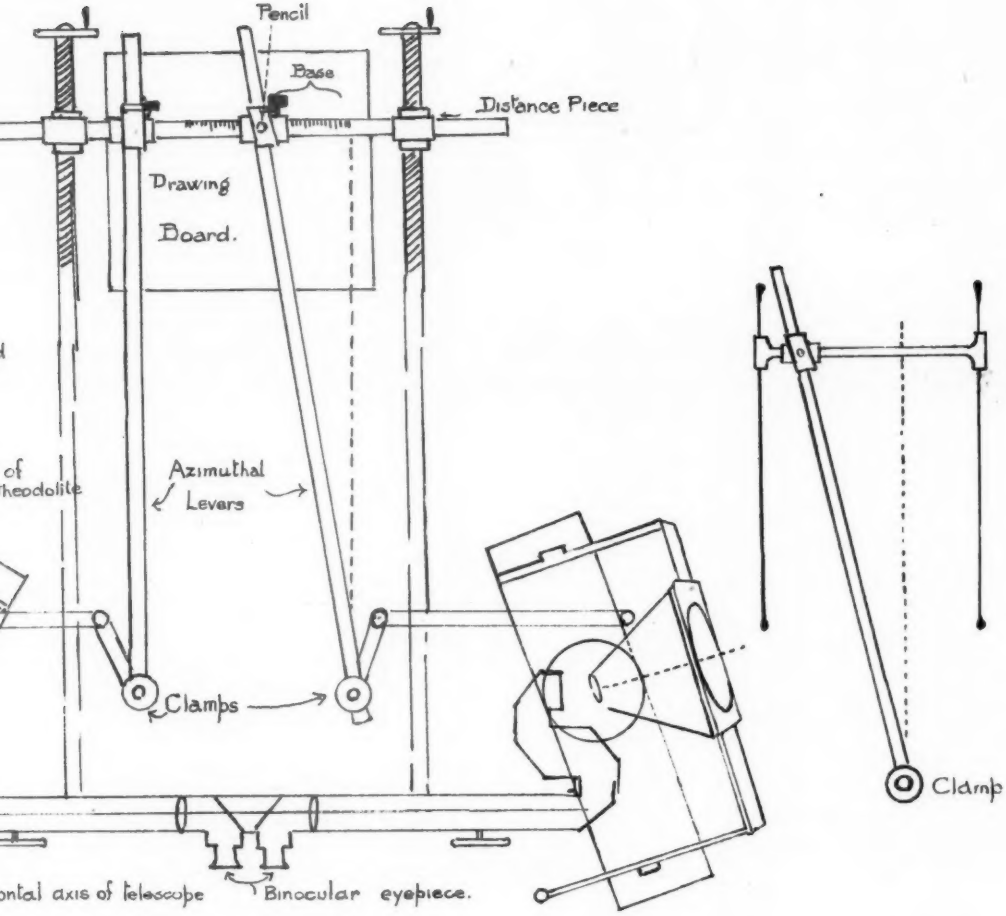


FIG. 2. Elevation.





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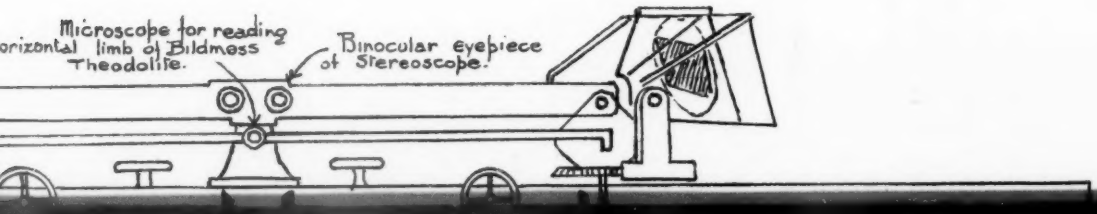


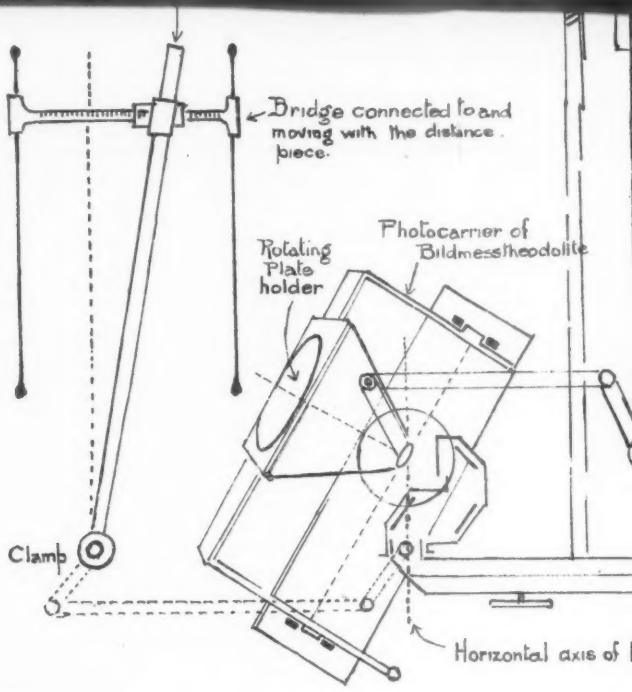
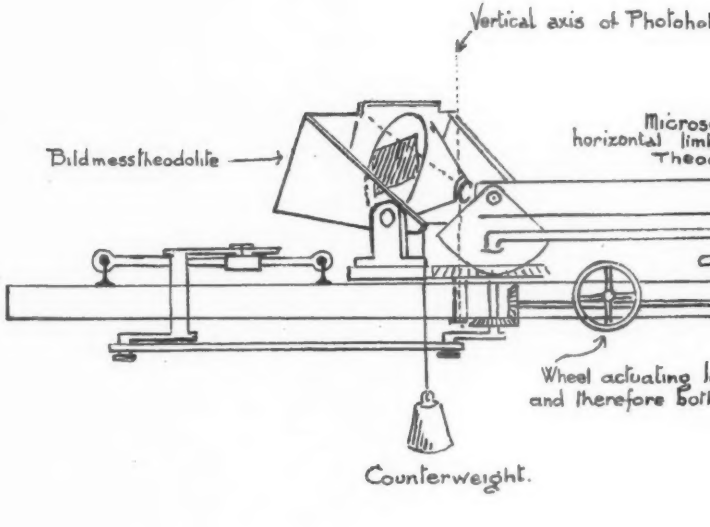
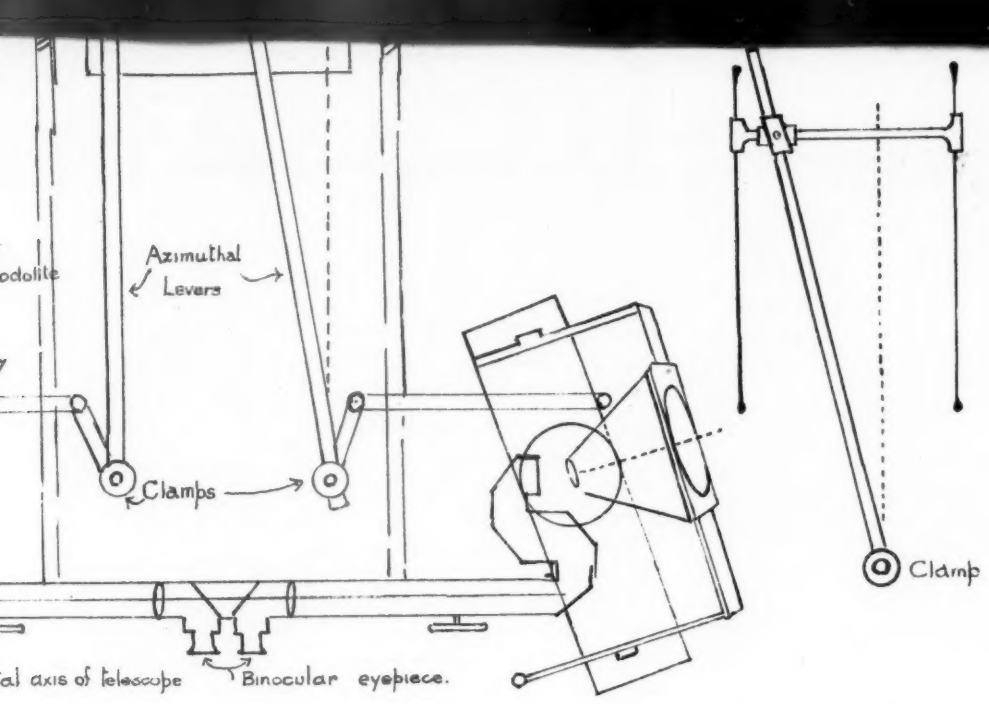


FIG. 2. Elevation.





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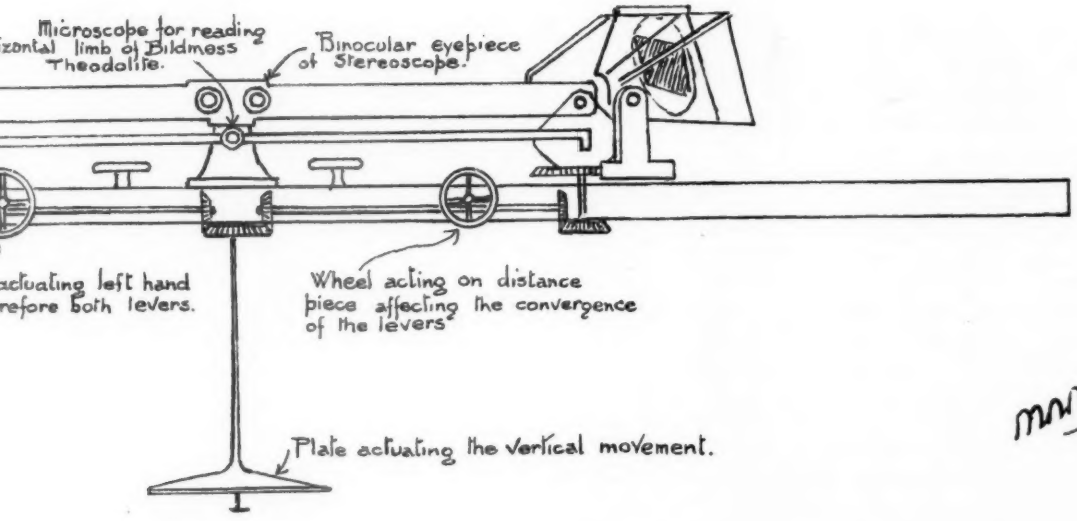

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STEREOGRAPHIC SURVEY.
MacLeod & Hinks.

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survey as much as he can from there. The stereoscopic principle is only used because it is believed to give more accurate results from a short base than "independent" observations from the two ends of it.

The "mobility" of the aeroplane is, however, not restricted by the configuration of the ground. Its most important and characteristic attribute is in fact its independence of terrestrial obstacles. It seems to me to be a fundamental mistake to adopt a method which makes no use of this unique power until it is found that no other is practicable.

No doubt in certain types of country, such as parts of Palestine where the ground is much "accidented" and at the same time devoid of conspicuous features and landmarks, the stereoscopic method would be extremely useful, but I would prefer to regard it as a preliminary to other and more accurate processes. I doubt, in fact, if the autocartograph can really yet be called a survey instrument of precision. In any case I feel fairly confident in saying that it has not yet undergone really searching tests.

I have received recently from the makers a report prepared by Herr Treitschke, head of the Saxon Topographical Survey, on a comparison of a plan prepared with the aid of the autocartograph against the ordinary 1/10,000 topographical map.

This plan was prepared from a single pair of photos, and no details are given of the data on which it is based. The comparison was made by measuring the 137 distances between 55 points on plan and map. The distances varied between 150 and 700 metres. The mean discrepancy is given as 0·63 per cent., individual errors varying from —9 to +8 metres—distances which, it will be noted, are only just plottable on this scale. The comparison of heights of the same 55 points, ranging over a vertical interval of some 120 metres, showed a mean divergence of ±1·22 metres, individual errors varying between —2·7 and +2·7 metres.

These figures are remarkably good, but in the absence of precise information as to the data, etc., from which they were obtained, it would, I think, be premature to draw final conclusions from them as to the ultimate value of the autocartograph. It would appear however that the instrument has considerable possibilities for carrying out *detail* survey, though it seems unlikely, owing to its great cost, that much use will be made of it until further tests have been made and more information is available as to the comparative cost of maps made with it as against present or alternative methods.

Discussion following the two papers by Mr. Hinks and Colonel MacLeod.

Colonel E. M. JACK: I agree with Colonel MacLeod that, on general principles, it is to some extent wrong to use the stereographic principle for aerial work, because, as he said, by so doing you forego the advantages given by the mobility of the aeroplane. On the other hand, if you make no use of the stereographic principle you abandon the advantage of being able to do auto-

matic plotting which includes contouring. With regard to the scope of the autocartograph, I do not think we know enough about it to be able to form any definite opinion. I certainly feel inclined to view with grave suspicion some of the claims made as to what it can do, and some of the results that Colonel MacLeod has just mentioned as being given by the makers seem to me altogether extravagant. As to the question of determining the accuracy of the point of view, Mr. McCaw has recently gone into that question in some detail, and I will leave him to speak on it. While the autocartograph deals with any photographs that can be combined into a stereoscopic view, the stereoautograph which Mr. Hinks described is confined, in the 1914 form, to stereophotos taken horizontally from ground stations. The application of this instrument is, therefore, much more limited; but it is evident from the conditions in which these photographs are taken that it should give more accurate results. There would seem to my mind to be a very distinct, though perhaps rather limited, field of usefulness for such an apparatus, that field being mainly the minutely accurate survey, on a large scale, of ground forms, especially of steep ground. I think there is something extraordinarily attractive in Mr. Hinks' idea of making accurate stereographic surveys in order to provide data for the determination of the rate of denudation. One may perhaps contemplate the possibility of a third expedition to Mount Everest, on which the objectives will be entirely scientific, and when such photographs might be taken. But Mount Everest is rather a special region, where I understand from the accounts that denudation is proceeding very rapidly. I would like to see similar surveys made in more normal and easily accessible regions where the results would be of more general application. At any rate it is a big idea, and I hope that something may come of it. We have to thank both Mr. Hinks and Colonel MacLeod for their very clear papers on a highly technical but most interesting subject.

Mr. G. T. McCaw: When I took up the *Journal* this morning I noticed a very interesting map which I saw that Mr. Hinks had prepared from photographs only, and it appeared to be a really wonderful accomplishment. At the same time, as a surveyor, I can quite imagine that when he and his assistants were working on that survey which you, Sir, are advocating among other things, he must often have thought that if only he had pictures from a camera provided with collimating points and a level, how much more he could have done and how much greater accuracy he could have got. And I think, perhaps, that that is the view-point from which he regards the question of the stereoscopic method of surveying in general. One feels that, under magnificent conditions with regard to air, a survey in a region such as that of Mount Everest can be made by photographic methods with really surprising accuracy. And if so much can be done by mere panorama, how much more, one argues, can be done with the stereoscopic method which, if not perfect, at any rate gives one a fair approximation to accuracy! I think, therefore, that the point of view of Mr. Hinks and of Colonel MacLeod is considerably different, and that probably explains the fact that they are, shall I say, slightly in opposition on this question of stereoscopic views. Colonel MacLeod is thinking of the pilot who is sailing through clear air and is absolutely free to take up any positions which are suitable for the survey. And so naturally the view-points must be different under those conditions. But if there is no great difference of opinion between the two authors, there certainly is a difference between the makers of these two instruments. Hugershoff has no use for the stereoautograph, and Pulfrich has in effect stated that the Dresden school do not understand the optics of their

own instrument. And perhaps Dresden feels inclined to criticize the Jena instrument because Dresden has adopted certain principles which Von Orel had already worked out, the distance piece and various movements being largely similar. With regard to the question of the method of using the stereoautograph in the field, I think one must say that as far as the instrument itself is concerned it has been brought nearly to perfection; but the method, as Colonel MacLeod has pointed out, is of course limited to a certain extent. You have undoubtedly got that very small angle which cannot exceed 15° if one is to have stereoscopic effect; and those who go in for the stereoscopic principle seem to cling to it too closely; they assume that one should stick to and abide by it. Supposing it is found that the stereoscopic principle will work only between 5 and 15 kms. (I would add 15 kms. under good conditions only), the, would apparently not use the stereoscopic method inside the 5 kms. That, I think, is a great mistake, because, though the stereoscopic principle introduces an improvement in the ratio of about 8 to 5, the accuracy of the method falls away with the square of the distance; the advantage of the stereoscopic principle is then more than compensated by the advantage of good intersection, even by using only the single eye, inside 5 kms.

Colonel MacLeod has referred to the question of the accuracy of these determinations of the air position, and Colonel Jack has asked me to say a few words about that. One may say that Prof. Hugershoff puts it at about ±1 metre in all dimensions; I think that is certainly somewhat too favourable as far as our results go. I cannot follow Colonel MacLeod when he speaks about the method of resection by the apex angles. You cannot have resection in space without using the apex angles, and the apex angles need not be so small as one would imagine. For example, with a plate of 18 by 24 cms. and a focal length of 20 cms., the apex angle may amount to 60°, and the average of the three may quite well amount to 40°. Even under unfavourable circumstances I do not think that the average apex angle should be less than 30°. With angles of that size the probable error is not so very considerable, and furthermore, I do not know any other method which is better. I am afraid if there are any objections to this method, they are objections which are inherent in the photograph itself. Just one more point before I close, and that is that, in describing his method for determining the air position, Prof. Hugershoff has made one very curious mistake. He assumes that his method will work under all conditions; and he supposes that in all circumstances only one approximation is necessary. That is not so. He seems entirely to have failed to realize the fact that in certain circumstances he cannot fix his position at all. If the aeroplane is on what I call the "danger cylinder," he cannot get his position unless it be exactly on one of six generators of that cylinder. The Fischer-Eggert method is much too laboured to be of more than mathematical interest and is in any case applicable to photogrammetry only. Hugershoff's method itself is unnecessarily ponderous and, as he omits to work out explicit values of the unknowns, he has failed to notice that the impossible case, explicit in Finsterwalder's method (which he too readily criticizes), is implicit in his own equations. I have developed two other methods, one of which is certainly preferable to Hugershoff's, and gives the unknowns explicitly.

It must however be recognized that both the instruments, described by the authors critically and without that extravagance to which the interested or the ill-informed are addicted, do in fact represent considerable progress within fairly well-defined spheres.

Major HENRICI, R.E.: I did not come with the intention of speaking, but

I have listened with very great interest to the papers. I noticed in a German publication (*Zeitschrift für Instrumentenkunde*, vol. 41) a little while ago drawings of eleven different varieties of the stereoautograph. They have not all been made; each one is more complicated than the last, and I believe the last would, at any rate on paper, account for pretty nearly every possible combination of angles between the axes of the lenses and the base, and consequently be of use for plotting from aerial photographs provided the position of the cameras at the moment of exposing can be fixed. I also saw what may be of interest to some of those who have not seen it, and that was a very simple method of plotting from the stereocomparator, not drawing direct but saving a very great deal of the labour of computing. I do not think I will stop to describe it now (it is described in the publication mentioned above). I have been very interested indeed, and very grateful to the authors for the trouble they have taken in explaining the instruments. I hope Mr. Hinks' suggestion that the stereoautograph should be used to make accurate large-scale maps of selected districts will be adopted; the results should be of great value in the future.

The PRESIDENT: I am sure we shall all endorse what has been said as regards the very great care with which Mr. Hinks investigated this delicate and complicated instrument last year at Paris, and thank him for the lucid way in which he has now explained it to us. We are also much indebted to Colonel MacLeod for having explained to us so clearly the principles of the autocartograph. Our preparations last year for the Mount Everest Expedition were so hurried that it was not possible to go into this matter thoroughly enough to equip the expedition with a photo-theodolite, but we think that Major Wheeler did make some use of the stereoscopic principle with the photographic apparatus he employed. But he was labouring under very great disadvantages. When he arrived in the neighbourhood of Mount Everest, the monsoon had pretty well set in. He described in his report how he used to go up day after day to heights of 20,000 feet and wait for the clouds to roll by, but unfortunately they did not roll by, and he had to come down again. Moreover, I dare say at 20,000 feet it may not have been possible to set out a measured base. So as yet we do not know what was done in that way, and on this year's expedition we shall not have survey officers. But I quite agree with what Mr. Hinks has said as to the great value of this method for making accurate surveys of certain prominent peaks and mountain configurations. It is unnecessary to go to the region of Mount Everest always, because that is very much out of the way, and there are interesting peaks and formations much more accessible. I refer especially to those in the Gilgit district of north Kashmir, Nanga-Parbat, Raka Pushi, and a number of other peaks which might be surveyed in this manner. It would also be interesting to observe glaciers closely as Mr. Hinks has suggested. They have been photographed; Sir Henry Hayden, the efficient head of the Geological Survey in India, took photographs of the snouts of those glaciers and recorded their exact position, and apparently they do recede and advance in a very peculiar manner. So the accurate survey of these great glaciers, certainly of the Baltoro and Hispar glaciers throughout their course, would be of very great value. I am sure you wish me, on your behalf, to thank the readers of these valuable papers.

THE INTERNATIONAL HYDROGRAPHIC BUREAU

The President of the Bureau, Vice-Admiral Sir John Parry, K.C.B., has, at the request of the Editor G.J., authorized the publication of the following note by Captain Spicer-Simson, D.S.O., R.N., Secretary-General.

THE idea of establishing an International Hydrographic Bureau is by no means quite new, for proposals to this effect had been made some years before the Great War broke out, though they did not take any concrete form until 1912, when an International Maritime Conference was held at St. Petersburg under the auspices of the Imperial Russian Government. At this Conference Monsieur Joseph Renaud, the eminent Director of the Hydrographic Service of the French Navy, put forward a suggestion which, if carried to its logical conclusion, would have resulted in the establishment of an organism of a character similar to that of the existing Bureau. Though some of the subjects discussed were directly hydrographic or were intimately connected with hydrography, the Conference occupied itself primarily with those which referred to navigation and the requirements of mercantile shipping.

For this and other reasons, among which was the fact that, unfortunately, Great Britain was not represented at the Conference, no practical result came of the suggestion.

However, this Conference showed clearly that an International Conference for the discussion and settlement of subjects connected solely with Hydrography would be of the greatest utility to all maritime states, and the British and French Hydrographers were in communication on the subject when the outbreak of the War forced them to concentrate their energies on matters of more immediate importance. As soon as the Armistice was signed, they decided that the time had arrived to take steps to convene a Conference of hydrographers. At Monsieur Renaud's suggestion London was chosen as the most suitable place, and the Hydrographer of the British Navy brought the matter before the Lords Commissioners of the Admiralty. Their Lordships decided that all Maritime States which possessed a Hydrographic Office should be invited to send delegates to an International Hydrographic Conference to be held in London in June 1919.

The response to this invitation showed the concurrence of the Governments of the Maritime States of the world in the proposal to hold the Conference, for the following were represented:

Argentine	Chile
Belgium	China
Brazil	Denmark
British Empire	Egypt
Australia	France
India	Greece
United Kingdom	Italy

Japan	Siam
Monaco	Spain
Netherlands	Sweden
Norway	United States of America
Peru	Uruguay
Portugal	

At this Conference Monsieur Renaud, warmly supported by Sir John Parry, the British Hydrographer, returned to the subject so near to his heart by producing a concrete proposal to establish a permanent International Hydrographic Bureau, which proposal was closely examined and adopted with but slight modification by the Conference, which appointed a Standing Committee, consisting of Sir John Parry, Monsieur Renaud, and Admiral Simpson (the Hydrographer of the U.S. Navy), to discuss the details, draw up statutes and an organization for the proposed Bureau, and finally to obtain the adhesion thereto of as many as possible of the Maritime States.

During nearly a whole year this Committee was in communication with the Governments of the States represented at the London Conference, obtaining expressions of opinion and reconciling these as far as possible.

Eventually the Committee drew up draft Statutes and an organization which proved acceptable, in principle, by all the States represented at the Conference, though some of them proposed minor modifications. By the beginning of May 1921 all the Governments, with the exception of those of Egypt, Italy, and the United States of America, had expressed their adhesion to the Bureau. The last Government however adhered to the Bureau shortly after the elections were completed.

The Italian Government had made certain objections with reference to the organization, but not long after its establishment Italy gave her adhesion to the Bureau, which now operates with the full support of the twenty-one most important Maritime States. It appears probable that the Egyptian Government will signify its adhesion to the Bureau as soon as the status of Egypt has been defined.

The Statutes are undergoing revision in order to incorporate the proposed modifications spoken of above. These do not affect the fundamental ideas underlying the original Statutes drawn up by the Standing Committee and based on Monsieur Renaud's proposals.

The objects for which the International Hydrographic Bureau was created are to establish a close and permanent Association between the Hydrographic Services of the Associated States, to coordinate their efforts with a view to rendering navigation easier and safer in all the seas of the world, to cause the national Hydrographic Offices to adopt the Resolutions taken by the various International Hydrographic Conferences, to endeavour to obtain uniformity, as far as is possible, in hydrographic documents, and finally to advance the theory and practice of the science of Hydrography.

The Bureau is a consultative body only, and has no authority whatsoever over the national Hydrographic Offices, which remain entirely independent. It must never deal with any subject which involves questions of international policy. It keeps itself in direct and close communication with the National Hydrographic Services of the associated States, and, if desirable, it will maintain communication with the Hydrographic Services of non-associated States also.

It studies all hydrographic subjects and in particular the documents published by Hydrographic Offices; it draws up and publishes various lists, such as of geographical positions, primary and secondary meridians, time signals, etc.; it studies the construction and use of hydrographic instruments and appliances, the principles of which have been approved by a national office, and the methods of hydrographic surveying, and makes researches on all other subjects which affect hydrography.

It will have a collection of all charts and works published by the various national Hydrographic and other offices of their own coasts and those of their colonies, as well as a full set of catalogues and index charts published by all countries. It collects documents published by these offices which are considered to be standard works, and such meteorological documents issued by the Hydrographic and Meteorological Offices of various nations which might prove useful to hydrography and navigation. These collections will be kept up-to-date, the national Hydrographic Offices having undertaken to send to the Bureau copies of all necessary new editions and publications. It is proposed to make a list (as complete as possible) of hydrographic documents or publications which are of historical interest and which are to be found in the various Hydrographic Offices or in libraries, together with information as to the office or library where each may be consulted.

Another important duty of the Bureau is the collection and distribution of information on the subject of hydrographic surveys or publications which are being prepared in the national Offices, whether the work be new or for the purpose of revision, and it informs the associated national Offices of questions which are of general interest or of hydrographic work of an international character which it might be useful to study or to undertake and endeavour to obtain collaboration between those States which are interested for the purpose of solving these questions.

If called upon to do so it will assist those States which have not yet established a Hydrographic Office, or which have Hydrographic Offices which are not fully developed, to establish or further develop such offices by giving advice; and finally, it organizes the periodical International Hydrographic Conferences which, in principle, meet every five years.

The Bureau is governed by a Directing Board which is elected by the representatives of the Governments of the associated States from among the candidates put forward by the latter, as also is the Secretary-General.

The first election took place in June 1921, and the following were

elected: Vice-Admiral Sir John Parry, K.C.B. (Great Britain), President; Rear-Admiral J. M. Phaff (Netherlands); Captain S. H. Müller (Norway); and Captain G. Spicer-Simson, D.S.O. (Great Britain), Secretary-General.

It is practically certain that Monsieur Renaud would have been elected but for his death, which occurred just as the elections were being held. The Bureau and Hydrography in general have suffered a serious loss, for Monsieur Renaud was not only a great hydrographic surveyor but also a great organizer. Unfortunately it was found impossible to obtain another candidate of French nationality in the time available.

Future elections will be held during the periodical Conferences, and the members of the Directing Board and the Secretary-General relinquish their posts after each such Conference, but they are eligible for re-election.

Each associated State has one vote only at the Conferences, except in the elections of the members of the Directing Board and the Secretary-General, when votes are allotted to the States in proportion to their maritime importance, as gauged by the amount of shipping tonnage, both naval and mercantile, flying their respective flags. The associated States contribute towards the upkeep of the Bureau on a similar basis, the minimum annual contribution being 4000 Swiss francs and the maximum 34,000 Swiss francs.

The fact that the Hydrographic Offices of most States are departments of their Admiralties or Ministries of Marine has given rise, in the mind of the general public, to the idea that Hydrography is a matter mainly connected with war. It is true that the possession of good charts, sailing directions, tide-tables, etc., is necessary to the successful conduct of war-like operations, but it is equally necessary for the successful carriage of passengers and goods overseas. To a maritime State like the British Empire, which depends on the sea for its trade and communications, the value of the Bureau is obvious, for it acts as an international clearing house for all information necessary to navigation.

The address of the Bureau is: Bureau Hydrographique International, 3, rue du Port, Monaco.

REVIEWS

EUROPE

Géographie Humaine de la France.— Prof. Jean Brunhes. Paris: Société de Librairie Plon. 1921. Pp. 495. *Illustrations and Maps.*

NOWHERE has there been a more express recognition of the intimacy of the relations between geography and history than in France. Michelet himself prefixed an elaborate account of the geography of France to his history; the introduction to the history of France by Ernest Lavisse is a thick volume on the same subject by a geographer, the late Prof. Vidal de la Blache, and now we have this large quarto forming only the first of two volumes by another geographer to be devoted to the geography of France, as the foundation for

the history of the French nation, which is to be treated of under various headings in thirteen subsequent volumes. The *Géographie Humaine* does not indeed make up the whole of the present volume. There is also a general introduction of 80 pages to the whole work written by the originator and director of the whole, M. Gabriel Hanotaux, of the French Academy, but these 80 pages are not included in the 495 pp. given above as the extent of the part of it given to geography.

In this introduction there are several remarks that tempt comment even from a geographical point of view, but we will confine ourselves to one bearing on the special subject of the present review. Speaking of Prof. Brunhes' conception of human geography the author says that "it shows man and the works of man as a function of the Earth; the two things given, the surface of the Earth and its inhabitants, are linked together; they are no longer to be separated; they mutually explain one another." This does in fact set forth the governing idea of our author. Geographers are sometimes accused of pressing the geographical influence on history too strongly. But no such accusation can be laid against Prof. Brunhes. Again and again throughout the present volume he insists on the fact expressed in the last words of the quotation just made from the introduction. At the outset (p. 4) he tells us that his aim is "to draw a picture of the physical environment in which the nation has formed and strengthened itself, of the territory in which it has in the strict sense of the term rooted itself, as well as of the changes in this environment and this territory of which men in the course of fifteen centuries of history have been the responsible authors." Again, in the chapter on the Provinces and "Pays" of France, he declares (p. 341) that in his mind "geography does not result solely from an assemblage of facts of nature, but from a combination of human actions and human labour with facts of nature, a combination in very truth creative of new facts," an idea to which he had already given expression with reference to "pays," "provinces," and even "regions" in his chapter on Climate and Rivers, where he remarks (p. 101) that these are not simple natural facts, but the issue "of such and such acts of human will in association with physical facts, that they are of necessity variable in their historical and vital expression as they have been in their limits." And in the two chapters devoted to the subdivisions so named he shows again and again how the same provincial and other name had varied in the course of time in its application, and in how many cases the provinces as they existed on the eve of the subdivision of France into departments consisted of parts geographically unlike and made one solely through the events of history, yet forming in the end a real unity.

After a preliminary chapter entitled "Le Visage de la France" the present volume is divided into two parts, one (written in collaboration with Paul Girardin) bearing the title "General Geography: the Permanent Framework and the Human Factor," and the other, "The Primary Principles of Regional Geography." But, as the author expressly points out, in his method of treatment he does not aim at following that of detailed regional description adopted by Prof. Vidal de la Blache, but rather under various headings such as the Architecture (geological structure) of the Country; Rivers, Relief, and Towns (with a regional subdivision indeed); Languages and Dialects; Regional Types of Houses, etc.; to bring into prominence that which is typical and distinctive, a mode of procedure which his intimate knowledge of France enables him to carry out with marked success begetting sustained interest. It may be pointed out that even in his treatment of climate, where he is bound to give some

broad general exposition, he delights in driving home his generalities (very effectively) by accounts of a particular cyclone and a particular anti-cyclone. Still, however eager he is to bring into relief the individual feature, he never forgets that he selects the individual as typical or fails to make it contribute to the formation of a general picture which, in his own words, "may prepare the minds of the readers to understand the elaboration of a nation." By way of illustration we may quote from his chapter on "Le Visage de la France" a passage or a portion of a passage presenting his view of what France essentially is, a view which may well make us ponder, thinking of the contrast thus offered to our own country: "So many joys and so many resources brought together in so many favoured districts were bound to disperse the forces and counteract in advance that hard and monotonous specialization which has been more and more imposed on civilization, and still more on industry. Our whole country has long resembled those happy districts; it aimed at securing for itself in all parts a little of everything, and the war, under the menace of blockade and exhaustion, has shown that it has not been altogether wrong" (p. 27). The work has numerous instructive maps in black and white and a large number of illustrations, not photographs as in the volume of Vidal de la Blache, but drawings (some coloured) mostly by A. Lepère—drawings much in harmony with the style and content of the text, vividly revealing the typical in swift and telling strokes and touches. G. G. C.

A Text-Book of European Archæology.— **R. A. S. Macalister.** Cambridge University Press. 1921. *Illustrations.* 50*s. net.*

This bulky volume of 600 large closely printed pages, dealing with only one phase of Prehistoric Archæology, the Palæolithic Period, may possibly frighten the student, especially when he is told that several more such volumes are to follow it before the subject is completed. He can however be assured that it is a very readable book throughout, written in a clear and easy style, and characterized by sane criticism and sober judgment. Moreover, the subject is set out and handled in such a fashion as to supply all the essential materia. necessary to enable the student to form an independent and unbiassed opinion on many of the controverted topics of Archæology. In three preliminary chapters, entitled "Geological, Palæontological and Anthropological Prolegomena," all of what may be called the accessory data, so essential to a thorough understanding of the subject, are clearly set forth. Although dealing with such a mass of detail these chapters are as readable as they are clear, and are by no means a mere catalogue of facts.

A chapter is then devoted to each stage in the career of Palæolithic Man, Lower, Middle, and Upper. In a chapter entitled "The Psychology of Palæolithic Man," a fairly complete sketch of Palæolithic art is given. Lastly, the period of the much-disputed "hiatus" is tackled, and the attempt is made to fill it in as far as possible with what the author calls Mesolithic Man. This chapter is one of the most useful in the book in that it describes in a succinct manner the Azilian and Campignian cultures, and their relation to Palæolithic Man on the one side, and Neolithic Man on the other.

The author's treatment and criticism of much-debated and disputed topics concerning Palæolithic Man are interesting. He subjects the views of the Eolithists to a searching and destructive examination, and the advocates of Palæolithic pottery do not fare much better. Those who, resenting the worship of the "Oriental mirage," would have us believe that man is autocthonous in Europe are shown to have little solid evidence at present to support them. The supposed glacial striæ on Neolithic implements which

some rash speculators have found sufficient to support a Neolithic glacial period (did not one celebrated collector of flints propound the existence of several such periods?) are easily disposed of. Lastly, many anthropologists who are jealous of the dignity and scientific standing of their science will welcome the author's remarks on the growing practice of publishing restorations of Palæolithic Man in the flesh. Some authors have given a very doubtful help to the study of Prehistoric Man by the fanciful pictures with which they have illustrated their works. "Such restorations," says Mr. Macalister, "it must be remembered, are of more than doubtful value. The slightest change in the soft parts of the cheek and nose makes profound differences in the whole appearance of the face; in fact, the same skull can carry many different faces. The modeller must choose one of them, and moreover must choose one phase of expression in the features depicted, and the tyro is apt to be misled into supposing that this is necessarily the real likeness of the owner of the skull." The restorers are even here let off more easily than they deserve. One could have wished the author had gone on to apply his powers of trenchant criticism to restorations when no skull is available, as for example of "Heidelberg Man" from the Mauer jaw.

Every one interested in Archæology who reads this book can hardly fail to look forward with pleasing anticipation to reading the volumes that are to follow on the later periods. It should be added that the text is supplemented by numerous illustrations, references, notes, and a good index. The book suffers from one disadvantage—the price—which must be prohibitive for the ordinary student, the person to whom it should be especially useful.

E. A. PARKYN.

ASIA

The Book of Duarte Barbosa, translated from the Portuguese text first published in 1812 A.D. and edited by **M. Longworth Dames**. Vol. 2. Including the coast of Malabar, Eastern India, Further India, China, and the Indian Archipelago. London: Hakluyt Society. 1921.

No sooner had this second volume of my old friend and colleague's 'Barbosa' been placed in my hands for notice in this *Journal* than there came the news that he had passed away, and such account as I can give, therefore, of his last book in the space at my disposal must be by way of farewell to a great scholar, whose life's work has been of permanent benefit to Oriental research.

This second volume, one need hardly say, is a worthy successor to the first, and the editor has had the good fortune to meet with invaluable assistance at the hands of Mr. J. A. Thorne, whose personal knowledge of the Malabar coast and its people is unrivalled, and of Mr. W. H. Moreland, especially in the matter of the identification of the "City of Bengala." The early date of Barbosa as a European traveller, his closeness and accuracy of observation, his extraordinary knowledge of the people he lived amongst and his capacity for obtaining good information regarding their neighbours, combined with his editor's invaluable notes, make this volume of unusual value, which unfortunately I can here merely indicate. The work consists of three sections —the Indian coast; the city of Bengala; and Further India to China; and it can be examined from four points of view—geography, ethnography, history with manners and customs, and philology. I can now only briefly consider the book from the first of these points of view, leaving the rest and a real examination of this remarkable joint achievement of past and present explorers into India and the Far East for other opportunities.

Barbosa in this volume commences with Malabar, and proceeds down the

coast to the "kingdom of Cannanore," mentioning a number of local place-names which are mostly identified with much skill and ingenuity. On one of these I would like to make the suggestion that by "river named Miraporam," which is identified with the modern Nileshwaram, Barbosa's informant may have meant a river named after a village or town called then Mirapura or something like it, which may possibly be still traceable. However, even large and important towns have a way down south of disappearing off the maps altogether in a comparatively short time; *e.g.* Ikkeri, a capital in the seventeenth century, is not now on the official map.

A note by Mr. Thorne on p. 80 in this connection gives one cause to think. He remarks on Maravel (Madayi) that "there are no Jews there now, but a Jew's tank (Chūla Kulam) exists on the hill near the Traveller's Bungalow." The fact that Chūla and the like, as South Indian names, may refer to the Jews and not to the ubiquitous Chōlas (Chulias, etc.) is well worth remembering.

On p. 82 Mr. Thorne has an identification of note in his remarks on "Cotaogatto," the Spanish form of Barbosa's Quategatam (Kottayam). He says it represents the oblique case "of the name Kottayam, which is Kottayakath, hence Kottioth and Cotiote of the Tellicherry [Malabar] factors." This statement is well worth bringing into prominence, as an explanation of European forms of West Coast names, which have long puzzled inquirers, myself included. Another good instance is Chiliate (Barbosa) = Ash-Shāliyāt (Ibn Batuta) from the oblique form Chiliyath of the name Chiliyam (p. 87). Another delightful instance of Barbosa's nomenclature is Tirangoto for Tiruvankōdu, the obscure village which gave its name to the modern State of Travancore.

On the well-known name Adam's Peak in Ceylon Mr. Dames has an illuminating note (pp. 117–118), commenting on Barbosa's term "Adombaba" therefor: "Barbosa probably heard the phrase Adam Bābā used of Buddha by Muhammadans. I have myself heard the God Siva called Bābā Adam in Northern India, and the identification of one of the leading gods with Adam may have come down from the Buddhist period." I am tempted to support this derivation by the reverse instance of Buddha Makān (Buddha's House) applied by Indian sailors to more than one shrine on the eastern coasts of the Bay of Bengal dedicated to their patron saint, Badru'ddīn Auliā of Chittagong, whereby Badr Maqām (Badr's Shrine) has become converted into Buddha's House from local Buddhist influence on folk-etymology.

It is also noteworthy that Barbosa's Otisa for Orissa neatly preserves the vernacular name, which is Oḍīsā or Oṛīsa. There are two more identifications on the coast which may be noted here. Barbosa's "mountain called Odirguamalado" obviously stands for Udayagirimalai, *i.e.* the Udaya Mountain Range: *giri* and *malai* both meaning "mountain" in local vernaculars. Then Mr. Dames refers to Fitch's "Servidore, whatever may be the modern name of that place" (p. 131), on the old trade route east and west in South India. I suggest that Servidore must represent Srīvattūr = Tiruvattiyūr or Trivetore in the Chingleput district, or perhaps Tiruvattūr or Trivetore in the North Arcot district.

Barbosa next alludes to the "City of Bengala," round which has raged an old controversy, to which Mr. Dames contributes perhaps the most important contribution of all.* He identifies it with Gaur, the mediæval capital. I cannot here go into this knotty question, but it has been long discussed by Bengali

* Cf. note in *Journal*, December 1921, p. 465.

antiquaries in their own language, who, I may say, incline to make it the mediæval Sunārgāon near Dacca.

The temptation to descant on the points of history, ethnography, and geography raised by Mr. Dames's notes on Barbosa's observations about Burma and the neighbouring countries is great, but I will restrict myself now to remarking that Sir George Scott's identification (for Mr. Dames) of the Gueos with the Wās is open to doubt. The Wā tribes are of the Mōn Race, whereas Gueos seem to have been Shāns, and it may be mentioned that the king with whom the early Portuguese dealt in Pegu was by birth a-Gwē Shān, though the dynasty was held to be Talaing and the people he ruled over were Talaings, *i.e.* a branch of the Mōn race. Barbosa also was wrongly informed as to there being no "Moors" in Burma, witness the long-established Zairbādīs, a mixed Burmese-Muslim people, exactly like the Navāyats, Moplahs, and Lubbays of India, and also the Panthays or Pathī immigrants from Musalman Yunnan.

Going down the coast of the Malay Peninsula Mr. Dames has drawn attention to M. Gabriel Ferrand's investigations as to the name Kedah and its relation to the term *qalai* for tin. I will only remark that from extensive inquiries of my own in the *Indian Antiquary* I am inclined to say that Mr. Ferrand's conclusions cannot be accepted unreservedly without further research. We must also be careful as to accepting the usual derivation of the name of Malacca from its myrobalans trees, since that name is given to several villages in the Nicobar Islands innocent of such trees.

When in the Malay Archipelago Barbosa has some very important observations on the "white folk" found in various places, which go to show that they are the result of waves of immigration from the north, *i.e.* ultimately from the Western Chinese highlands. Returning to the Asiatic Continent Barbosa calls "Chāmpā" (Cochin China) "a very large island," due to a common misconception of various forms of the Indian term *dvīpa*, meaning "a continent, a country," as well as "an island."

Barbosa's last geographical note is on the Lequeos or Liu Kiu Islands, south of Japan. Mr. Dames notes that Liu Kiu is Riu Kiu to the Japanese. This is due to a linguistic peculiarity. The Chinese use *l* where the Japanese say *r*, and they have a reciprocal difficulty in pronouncing these sounds.

I must here close what I feel to be inadequate observations on one phase only of this remarkable book, which is not only a great credit to its editor and his helpers, but constitutes a distinct advance in Oriental learning.

R. C. TEMPLE.

Across Mongolian Plains: a Naturalist's Account of China's "Great North-West."— Roy Chapman Andrews. New York: D. Appleton & Co. 1921. *Illustrations.* 25*s. net.*

In the volume under review the writer gives a vivid account of his sporting experiences in Mongolia, Shansi, and the grounds of the Eastern Mausolea of the Manchu Dynasty, in the neighbourhood of Peking. The journeys were undertaken in the interest of the American Museum of Natural History, and every assistance was given to the prosecution of his aims not only by the U.S. Embassy, Mongol and Chinese princes, and local authorities, but also and not least by American merchants at Tientsin, Kalgan, and Urga. The last-named place was made the base of the author's excursions in Mongolia, in most of which he was accompanied by his wife, to whom the book owes a number of excellent photographs.

The writer and the reader share a sense of horror at the intrusion into Mongolia of motor-cars and apparatus for film pictures, and to both of them the trips on horseback into the plains, or on foot into the forest country north of Urga and the mountains near Kuei-hua-chêng, probably carry the greater charm. But motor-hunting of antelopes and wolves with cars driven at full speed across country must be extraordinarily exhilarating. They also furnished an opportunity of testing the speed of the animals chased, which is fixed at about 55 miles for antelopes and 35 miles for wolves. In the latter case, the chase was pursued on one occasion for 12 miles and the wolf escaped!

Motor-car experiences were rivalled, if not excelled, when hunting antelopes on horseback and stalking wild sheep (*Ovis commosa*), wapiti, and boar. The sportsmen were most fortunate in their choice of localities, and Mr. Andrews must be a first-class rifle-shot. The scientific result of the expeditions will appear in the museum's publications.

Mr. Andrews concludes with an appeal for the preservation of the park at the Imperial Mausolea, as it constitutes the last home of many species of fauna, which are threatened with extinction by forest fires lighted by peasants in search of fresh ground for cultivation. The extent of ground on the Mongolian plateau which is already broken up by Chinese immigrants and the rich prospects in view for farmers in the future are dwelt upon with great emphasis. W. R. C.

India, Old and New.— Sir Valentine Chirol. London: Macmillan & Co. 1921. 10*s. net.*

A good deal of this work has been already before the public. There is now added a short historical sketch, which includes the influence of Musalman domination, and the general thread and tendency of British policy in India, as correlated with the course of political conceptions at home, the whole being brought to bear upon the conditions of the present day. It is well, too, that the paper upon the enduring power of Brahmanism has been reproduced here, for it contains a good deal which helps to account for the state of opinion amongst influential classes of Indians just now. Of the rest, special attention may be given to the introductory portion and the concluding chapters, which end with August last. New wine has fermented in a manner not anticipated, and an observer with the experience and repute of Sir Valentine Chirol knows he need not shrink from modifying views formed even within the last decade. It is outside the scope of this *Journal*, however, to enter into that part of the subject, beyond mentioning that the author, whilst admitting the gravity of the situation even last August, still, in December, did not "despair of the State." J. A. B.

AFRICA

The East African Force, 1915–1919.— Brig.-Gen. C. P. Fendall, C.B., C.M.G., D.S.O. London: H. F. & G. Witherby. 1921. Pp. 238. *Illustrations and Map. Price* 16*s. net.*

Brigadier-General C. P. Fendall was appointed to the staff of the East African Force on its creation in November 1915, and from early in 1916 down to disbandment of the Force in 1919 he served in administrative capacities in East Africa, first as A.A.G., later as D.A. and Q.M.G. His record of the campaign is stimulating: of the fighting in which, necessarily, he took no part, we are told enough to make the strategy of the British commanders intelligible; upon the difficulties met with in maintaining transport and supplies we get a vivid light. On this aspect of the campaign no other volume is

so informing or so full as is General Fendall's. Only by an attentive reading of the dispatches of Generals Smuts, Hoskins, Van Deventer, and Northey (and notably that of General Hoskins) could the reader otherwise acquire an adequate conception of the obstacles which beset the administrative staff in their efforts to provide for the needs of the fighting force.

There are in this book several statements which, from the military standpoint, challenge consideration and may give rise to controversy, especially in South Africa ; on one point many will agree with General Fendall—they will share his regret that General Hoskins was not able to reap the reward of his re-organization of the Force after the departure of General Smuts from East Africa.

The difficulties of transport and supply, which are the main theme of the book, were infinitely greater than they would have been in any part of Europe of the same area. This was due in large measure to the tropical climate and its attendant diseases, the alternating rains and droughts, the nature of the soil, the bush, and the necessity of depending to a great extent on animal transport and carriers. General Fendall discusses convincingly all these factors, besides pointing out others which helped to render the transport available always insufficient.

Events before the arrival of General Smuts at Mombasa, together with the operations of General Northey and the Belgians receive the minimum of notice ; the publishers, and not General Fendall, are responsible for the statement that his pages "represent the first detailed account, by an authoritative pen," of the campaign. F. R. C.

Among the Hill-folk of Algeria. Journeys among the Shawia of the Aurès Mountains.— M. W. Hilton-Simpson. London : T. Fisher Unwin. 1921. Pp. 248. *Map and* 42 *Illustrations.* 21*s. net.*

This is an excellent book which well repays careful perusal. The Hill-folk of whom the author writes (at greater length than was possible in the paper read before the Society last November) are the Shawía tribes in the Aurès mountains of eastern Algeria. This mountainous region is the highest and most easterly of the various massifs "in the range of hills which, more or less continuously, forms the northern boundary of the Sahara desert, from the Atlantic to the Gulf of Gabès on the Tunisian coast," whilst in this section it merges on the north into the less rugged central plateau of Algeria. Of the Aurès massif itself, the Mons Aurasius of Roman times, the author says, "Were we to traverse it from north to south we should find that its northern slopes are well wooded, its high central valleys less extensively so, while in the south its few poor streams flow through a tumble of barren hills till they lose themselves in the great desert. . . . This mountainous massif of the Aurès is peculiarly well fitted from its geographical position to be the home of ancient survivals, for it offers to its inhabitants magnificent natural facilities for defence against any invader who might be tempted to subjugate them."

Here live, and from time immemorial have lived, the Shawía tribes of Berber stock. Never definitely conquered by the sword until the French invasion of about 1845, these people retain even now many of the manners and customs of people living in a prehistoric period. "Members of the ancient Berber race, their fair hair, blue eyes, and complexions which are pale beneath the tan produced by the great heat of the African summer, distinguish them at a glance from the darker Semitic and negroid types of the desert ; while the old Berber language, though no longer written, is still spoken by the Shawía

tribes, as the Berbers of the Aurès are called, who have never adopted the Arabic of their new faith."

It was ethnographical research that impelled the author and his wife to spend no fewer than three winters of the period 1912–1920 wandering about in this little-known but fascinating region—living among the shy and often suspicious, but friendly and hospitable, tribesmen, and acquiring an intimate knowledge of them and their ways, such as few or no other Europeans possess.

Describing a typical village situated upon a rocky spur to the east of the great mountain ridge of Jebel Shershar, the author says, "Upon a mighty mass of rock literally overhanging the fertile valley 200 feet below it, stands the village of Djellal. Its houses, built flush with the cliff edge, crevices in which are even bridged by logs whereon to rest their rough stone walls, unapproachable save along the neck of land which joins the spur to the hill on the western side of the valley, Djellal is invisible from any distance when approached from the north, for its buildings are indistinguishable from the rocks on which they stand."

Much of the book is naturally devoted to ethnography. The primitive systems of agriculture, weaving, pottery and many other arts and crafts are fully described, including the system of "seggias" or canals, by which the scanty supply of water is distributed to the patches of cultivated ground, and the water-clock by which the flow of water is timed, and which was described by the author in the paper read before the Society.

As might be expected, magic and superstition play a large part in the life of this primitive people. The ceremony of the ladle with its prayer for rain, the strange antics of the Sorceress of the Moon, the charms that are hung on the person or attached to dwelling-houses, marriage ceremonies, and many other customs are fully described. An important chapter is devoted to medicine and surgery. In this region can still be found men who practise the healing art as it has been handed down to them from very early times. Indeed, the author's description of the operation of trepanning as practised at the present day by the Shawía doctor shows that it can differ but very little from that which we know to have been performed in the remote Stone and Bronze ages. To the reviewer, himself familiar with this operation, it is interesting to note that the Berber practitioner performs the operation in almost exactly the same way that the most modern surgeon, in the best interests of his patient, would himself perform it, *were he obliged to do so with the tools that alone are available to the Berber, and under similar conditions.*

Among the numerous excellent illustrations, which are from the author's own photographs, may be specially mentioned, from the geographical point of view, those of the cliff-top village of Jellal, the Rassira Cañon (recalling, though on a much smaller scale, the great cañons of the Colorado), the villages of Kheirane, Taghut, and Khanga-sidi-Naji, and the fine defile of Taghanimin, very similar to many others which form such striking natural features both in Algeria and in Tunisia.

Those who may desire to explore the Aurès for themselves will find helpful details in this book, and especially in the two appendices. One deals with seasons, clothing, equipment, saddlery, stores, maps, and expenses. The other is for sportsmen, giving practical hints to those who desire to shoot the Barbary sheep, the gazelle, the wild boar, and other game animals of Algeria. The book is well got up, and has a useful map of the region and of the author's routes. It can be strongly recommended both to the general reader and to any one who thinks of paying a visit to these interesting hill tribes.

J. B.

GENERAL

Life of Alfred Newton, Professor of Comparative Anatomy, Cambridge University, 1866–1907.— A. F. R. Wollaston. With a Preface by **Sir Archibald Geikie, O.M.** London: John Murray. 1921. 18*s. net.*

The subject of this memoir was for more than half a century a conspicuous figure in Cambridge, wherein he occupied a Chair with great distinction for over four decades. Lamed in his early years by one accident, and more permanently so by a second at a later period, Alfred Newton, debarred from the more active pursuits of life, found his chief enjoyment in watching and recording the habits of the wild life in his father's woods at Elveden in Suffolk, their bird inhabitants specially so fascinating him that ornithology, the science in which he was to attain such pre-eminence, became thereafter the devotion of his life. In 1866 Newton was elected Professor of Zoology and Comparative Anatomy in his *alma mater*, Cambridge. The warmest devotion to his early love marked the whole of Newton's professional career; and though in his heart he entertained little affection for other departments of the animal kingdom to which his Chair was wedded, and less for Comparative Anatomy—from which he later gladly obtained a divorce—he so conscientiously did his duty that the University, in which at his appointment biology was little regarded, had at his death, largely through his influence, become one of the most celebrated schools of Natural Science in Europe.

Prof. Newton was never a Fellow of this Society, yet for one handicapped as he was by lameness he made surprisingly long tramps and cruises, always with a scientific purpose. He visited Lapland, the West Indies, North America, Iceland, Denmark, Spitsbergen and Heligoland, rarely returning without results valuable not only to zoological but often incidentally to geographical science. While his "soul hungered" without hope of gratification after personal acquaintance with Nature in her more unfrequented fields, he inspired others to it. He was possessed of a fearless and indomitable spirit, and a pride of independence dangerous to one with his infirmity. Without it, so spirited a man would doubtless have become, as Sir A. Geikie remarks, "a dauntless pioneer in zoological regions as yet unexplored." Much consideration was given by Newton to the subject of Geographical Distribution of life, which he looked upon as having a most important bearing on evolution, and to which part of his Presidential Address to the Biological section of the British Association in 1887 was devoted. In his *magnum opus* ('A Dictionary of Birds'), Geographical Distribution has a prominent place. He was distinguished for the quickness and accuracy of his eye as an observer; for his "great wealth of knowledge, untiring research, and an unusual degree of accuracy" in his published work; and was remarkable for the pure English in which he expressed himself.

Newton's biographer has depicted for us the character of a learned and in many respects a very remarkable man, staunch to his friends and pupils, full of kindness, "one of the most lovable of men." He was immovable in his opinion of men and things after "carefully envisaging his question." For instance (p. 70), "he was accustomed to call by a most uncomplimentary name those monthly meetings and dinners of the British Ornithologists' Club"—an offshoot of his very own child the B.O. Union—"which have done so much to advance the study of ornithology"; and (p. 235) he had "a deep-rooted dislike of the British Museum Catalogue of Birds"—with all its faults a monumental contribution to the study of his favourite science, and to which by the way several of his bosom friends were contributors! It was unfortunate for both

the Club and the Catalogue, so far as Newton's imprimatur was concerned, that the inception of both was due to the same ornithologist, whom he personally disliked.

If those who sleep beneath the grass take note of sublunar affairs, Prof. Newton must in his rest feel deeply gratified that this pious and sympathetic memorial has been reared to him by Mr. Wollaston, his distinguished pupil. No one could have more appropriately undertaken the task than one who, steadily following the paths along which his master pointed, has time and again come back laureated from never-before-explored fields with lore that would have delighted the Professor, and has but yesterday entwined among his bays the amaranthine asters from around the virgin but appalling pinnacles that tower above the Roof of the World. H. O. F.

A Memoir of Lieut.-Col. Edward Anthony Steel, R.H.A., R.F.A.— Colonel J. P. Steel. London: Simkin, Marshall & Co. 1921. Pp. xvi. and 172. *Illustrations. Price* 6*s.*

Col. J. P. Steel has done wisely in compiling this memoir of his son, one who gave his life in the great cause of freedom, and who now sleeps in a far-off grave in distant Siberia. Edward Anthony Steel was a typical English gentleman and soldier—one whose life and career were like that of many another officer. Hence the peculiar value of this record, for we see in Edward Steel no brilliant genius but a man with just those qualities which are the greatest of British assets. Though he died young—he was barely 39 when the finger of Death touched him—he had a record of good work done, of worthy tasks worthily accomplished. As a subaltern he was in India ; then for nearly four years he was in Nigeria with the West Africa Frontier Force ; and he will be well remembered by many Fellows of this Society for his excellent work in the survey and delimitation of the Rhodesia-Congo frontier. He returned from Central Africa in July 1914, and by the September following was in France. Twice wounded and long in hospital he went out in 1918 to Mesopotamia, and next volunteered for service in Siberia, where he trained Russian officers in artillery. With his lungs perforated by bullet wounds he proved unable to bear the rigours of the climate and died at Omsk in October 1919. We are given the story of his life mainly through his diaries and letters, and in them we get a picture of a man of action, keen in his profession, fond of sport, full of the zest of life, considerate, observant, hopeful, helpful. From first to last he ran a straight race. F. R. C.

Alphabets of Foreign Languages transcribed into English according to the R.G.S. II. system.— Major-General Lord Edward Gleichen and **John H. Reynolds.** London : R.G.S. 1921. Pp. xvi + 72. 7*s.* 6*d. net.* (6*s.* to Fellows, at the Office of the Society.)

This, the second of the R.G.S. Technical Series, arises from, and is for the future guidance of, the work of the Permanent Committee on Geographical Names, which is already familiar to readers of the *Journal*. Its publication is a courageous act, for it is certain to be attacked by one school or another of philologists and phoneticians ; and it is important to remember the precise purpose for which these transliterations of alphabets have been compiled.

The Permanent Committee exists to unify and standardize foreign place-names for the use of Government Departments (and it is hoped that non-official bodies will gradually concur) both in their ordinary correspondence and publications, and more especially in any maps, charts, and plans which they

may issue. For this latter purpose two things are necessary: first, as the users of such maps will often be persons without linguistic training, the names on the maps must represent to the unspecialized reader the local pronunciation of such names; and second, diacritical marks must be avoided as far as possible, as in a map with names so close to one another that they are almost touching, marks above or below letters cannot but lead to confusion and illegibility. The critic who bears these two essentials in mind will forgive what will appear to him many inconsistencies and imperfections; the compilers have had to struggle with a refractory material, and they have made the best of it.

The book begins with a "table of spelling and pronunciation," *i.e.* the actual sounds given to the Latin letters used for the transliterations and the (very rare) use of accents, long and short marks, inverted comma, and apostrophe. It then proceeds to the alphabets themselves; those of Asiatic languages (except Arabic, Turkish, Persian, and Malay) are for the present omitted "owing to their vast number and extreme complexity." They are conveniently arranged in groups—Teutonic, Keltic, Romance, Slavonic, Baltic, other Indo-European languages (*i.e.* Albanian, Greek, Armenian), Caucasian (= Georgian), Finno-Ugrian, those in Arabic script, Semitic (other than Arabic, *i.e.* Hebrew and Amharic), and Miscellaneous (= Basque). The written characters are given for languages in which these differ materially from the printed characters (*e.g.* German gothic, Russian, Serbian, Greek), and the very full account of the Irish alphabet and difficulties of spelling is likely to be useful in the next few years!

Criticism will probably be most active on the group of languages in Arabic script. A certain inconsistency has been forced upon the Permanent Committee by the existence of modern and valuable maps, in constant use by military and civil authorities, proceeding from the Survey of India on the one hand and the Survey of Egypt and the Sudan on the other, and using different systems of transliteration; and a third system still is employed by the General Staff, India. It is impossible to "scrap" the productions of any of these, and the Egyptian Survey system will be used for Egypt and the Sudan, the Indian Survey for India, and that of G.S. India for Mesopotamia, except that final *h*, when not sounded, will be omitted; for all other Arabic-speaking countries a table of transliteration has been produced which is nearer to that of G.S. India than either of the others; indeed, it is almost identical so far as consonants are concerned. It is, of course, unsatisfactory that *t* must represent both ت and ط, and *dh* both ض and ظ; but the necessity of avoiding diacritical lines and points makes it necessary. Useful notes call attention to the special pronunciation of ج in Egypt and the various Moroccan differences.

It is not to be expected that these "Alphabets" will be widely used in philological or linguistic work; but, for the practical purpose for which they are intended, they seem the worthy result of much labour, good judgment, and a reasonable spirit of compromise, and it is to be hoped that they will be widely adopted by map-drawers and historians, and in commercial circles.

S. GASELEE.

A History of the Whale Fisheries.— **J. T. Jenkins, D.Sc., Ph.D.** Pp. 336. London: H. F. & G. Witherby. 1921. *Illustrations.* 18*s. net.*

Great as British interests in whaling have been in the past there has been a lack of a general history of the subject which could compare with the works of Müller, Brinner, or Tower on the Dutch, German, and American whaling respectively. Dr. Jenkins in this volume traces the history and development

of whaling from the Basque fisheries of the tenth century to the South Atlantic finner whaling of the present day. The task was a large one, but on the whole it is well done, although extreme compression in parts has robbed the story of vividness in some periods. The Spitsbergen and "Greenland" whaling in the early part of the seventeenth century is fully treated, even though Conway and others have previously made it familiar, while the sperm whaling and modern finner whaling, which is far less familiar to readers in this country, receives much briefer notice. A useful bibliography of books on whaling is added, but we are surprised to see no mention of Burn-Murdoch's 'Modern Whaling and Bear Hunting,' the use of which would have added colour to Dr. Jenkins' story. The Report of the Interdepartmental Committee on the development of the Falkland Islands Dependencies is quoted, but fuller use of it and the Colonial Office reports on the Falkland Islands would not have been amiss. A few corrections in facts may be noted. The parts that Ross in 1843 and Bruce and Larsen in 1892–3 did in drawing attention to the possibilities of whaling in the Southern Ocean are not fully appreciated; in fact the *Jason* is not mentioned. The South Orkneys and Sandwich Islands (? South Sandwich Islands) can no longer be classed among good whaling areas (p. 282). Since 1915 there has been no station at the South Orkneys, while the South Sandwich Islands are avoided by whalers and have never had a station. Among sperm whaling areas the Seychelles is not mentioned although it was a resort of whalers as long ago as 1823, and was the site of a Norwegian whaling station in 1914–15. We also miss any mention of the Auckland Islands, which Wilkes wrote of as the rendezvous in 1840 of about a hundred whalers of various nationalities. The discovery of Spitsbergen is attributed to Heemskerk (p. 70) and to Barents (p. 77). While the credit is doubtless due to both, this way of apportioning it tends to confuse.

It is not quite correct to say that Norwegian wintering began in Spitsbergen in 1904–05. If it did not become common before this century it had at least begun a hundred years ago. The use of the term Disco on pp. 122 and 123 should be made clear as applying to the south-east of Edge Island. Dr. Jenkins would have been well advised to pay more attention to the spelling of place-names. There may be justification for using original spellings even though they tend to disguise the localities designated, but no case can be made for the indiscriminate use of both ancient and modern forms. Thus Bear Island, Cherie Island, Cherry Island, and Beer-en-Eiland are used as synonyms within a few pages. Fotherby's spelling, Maudlen for Magdalena, is a little confusing. Horne and Horn (sound), Greene and Green (harbour) and Bell (sound) and Belsound are other variants. The Galapagos are persistently spelt Gallipagos, while both Marian and Marianne are used for the Ladrones. These and other comparable blemishes should be attended to in a future edition, which we hope will be not only enlarged but also furnished with maps and more recent statistics. The only map in the volume is a reproduction of the Muscovy Company's (Edge's) map of Spitsbergen.

R. N. R. B.

THE MONTHLY RECORD

THE SOCIETY

Medals and Awards, 1922.

HIS Majesty the King has been pleased to approve the Award of the Royal Medals as follows: *The Founder's Medal* to Lieut.-Colonel C. K. Howard-

Bury, D.S.O., for his distinguished services in command of the Mount Everest Expedition of 1921; *The Patron's Medal* to Mr. Ernest de K. Leffingwell, for his surveys and investigations on the coast of northern Alaska. The Council have awarded *The Victoria Medal* to Mr. J. F. Baddeley, for his great work on the historical geography of northern Asia; *The Murchison Grant* to Mr. Charles Camsell, for his explorations and surveys in northern Canada; *The Back Grant* to Khan Bahadur Sher Jang, for his surveys on the Indian Frontier and in adjacent countries; *The Cuthbert Peek Grant* to Mr. F. H. Melland, for his explorations in Northern Rhodesia; *The Gill Memorial* to Mr. A. A. R. Boyce, for his triangulations in the Sudan.

EUROPE

British Phenology and Climate.

Although the Royal Meteorological Society has for many years collected records of the periodic seasonal phenomena of vegetation and animal life in the British Isles with fairly accordant results, confirming the existence of a certain "bio-climatic" law that the spring is in general retarded four days for each degree of increase of latitude and for every 400 feet increase of altitude, but without (in these islands) showing any definite relation to longitude, it has long been felt that the present method of observation leaves much to be desired. Owing, however, to the complex character of the phenomena in question and to the fact that only a few among the large army of observers would be qualified to undertake a more elaborate system of observation, no attempt at innovation has hitherto been made. Last year Dr. E. J. Salisbury, in a paper entitled "Phenology and Habitat with special reference to the Phenology of Woodlands" published in conjunction with the phenological report for 1920 (*Quarterly Journal of the Royal Meteorological Society*, October 1921) has demonstrated scientifically, what indeed will be supported by every close observer of the countryside, that internal biological factors play a most important part in determining the times of leafing and flowering, and deserve far more attention than they receive in studying the influence of external meteorological conditions. So important, for instance, is the question of adaptation to habitat in woodlands that the herbaceous ground flora finds it necessary to foliate in the late winter before the forest foliage of early summer intercepts the light; and all kinds of variations show the importance of habitat and the meteorological character of the previous season in deciding the earliness or otherwise of a particular season. The influence of current weather over vegetation in a particular season is, of course, often conspicuous; but it is very irregular and, on the whole, causes comparatively slight variation from the average date for a given species established during long adaptation to climate. In fact, so dominant is force of habit that, as Dr. Salisbury points out, deciduous trees from the temperate zone, when grown in the tropics, tend to retain their periodicity for a long time.

It is to be hoped that when the called-for revision of phenological observation is attempted it will be done according to a carefully thought-out scheme, and one which will pay as much attention to the dates of autumnal as of spring events, together with the relationship between the two. Thus, in accordance with the above law, the oak will burst into leaf and flower a week or more earlier in southern than in northern England, whence it might be inferred that defoliation would be correspondingly deferred in the north to await the ripening of the acorns, as may be seen in comparing individual trees in the same locality. But harder climatic conditions in the north are unfavour-

able to any such delay in defoliation, and presumably the critical factor which sets a northern limit to the oak, as a flourishing species, somewhere about the middle of Scotland, is the time available for fructification.

The Sunny and Shady Sides of Alpine Valleys.

The importance of exposure to sunlight in Alpine valleys is so well recognized by their inhabitants that special terms are in use in many districts to distinguish between the sunny and shady slopes. In the French Alps the terms *adret* and *ubac* are constantly so used, corresponding to the Italian *adritto* or *indritto* and *opaco*, signifying the slopes directly exposed to the sun's rays or lying in the shade. Modifications of the French terms sometimes used are *endroit* and *envers*. Some striking instances of the influence of such differences upon the economic life of the valleys are given by Marcelle Vessereau in the *Annales de Géographie* for September 1921, the facts being in some cases brought out by means of actual figures. Broadly stated the general principle is that glaciers, cirques, forest, face the north, the shade; villages and cultivation, the south, the sun. In the upper Val de Conches, one of the two special instances discussed, it is found that 57 per cent. of the unproductive area and 61 per cent. of the forested area lie within the *ubac*, while of the productive belts 70 per cent. of the meadow lands and 97 per cent. of the whole cultivated area fall to the *adrec*. Again, twelve out of fourteen of the villages, and 87 per cent. of the population are concentrated in the *adrec*; where hamlets exist in the *ubac*, some topographical feature can be found to account for their presence, *e.g.* the entry of a side stream bring down a cone of detritus. As a rule each portion of the *ubac* is a dependency of the corresponding village in the *adrec*. In the lower part of the valley the contrast is less forcible, as the spots favoured by topography become more numerous. Still more striking are the conditions in the valley of Molines in Queyras, whose direction is more nearly east and west, and where by far the greater part of the pasturages are on the north side of the stream (facing south), while the other is almost given over to woods and unproductive ground. Besides the differences in the percentages already noted there is a difference in the altitudinal limits and in the general aspect of the two zones. Such contrasts increase with altitude, and may be either increased or lessened by topographical peculiarities. It is of course in the upper parts of the valleys, where the angle of slope is greatest, that the *ubac* is longest in shade, though it rarely is entirely deprived of sunlight; in valleys running east and west the *ubac* is always at a disadvantage as regards duration of sunlight, and an added effect is due to the difference of the angle of incidence of the sunshine. From a detailed study of the distribution of woodland and of population in a considerable number of valleys it is found that the contrast is most marked in the east-west valleys, while in those running north and south it is weakened or the conditions may even be reversed.

ASIA

Mr. Johnson's Ascents in the K'un-lun south of Khotan.

Mr. Johnson's work in the K'un-lun during his adventurous trip to Khotan in 1865 has attracted much attention from the fact that, if his claim to have ascended the triangulated peak E 61 (23,890 feet) were substantiated, he would long have held the record for highest altitude anywhere attained. While some have been disposed to allow the ascent of the peak in question, though reducing the height claimed for it, others (including General J. T. Walker and Mr. Freshfield) without in any way impugning Mr. Johnson's good faith, have

thought that he was mistaken in his identification of his peak with E 61, and that the former was a different and lower peak. Dr. Longstaff on the other hand was inclined to support the claim that the summit of E 61 had really been reached. The question has been carefully investigated by Major Kenneth Mason of the Survey of India, and there seems little doubt that his conclusion, that E 61 was not climbed, is the correct one. His discussion, based on careful search in the records of the Survey of India, appeared in the *Alpine Journal* for November 1921, with a supplementary note by Sir Aurel Stein, who first put before Major Mason the puzzle awaiting solution, due to the fact that his own explorations in the K'un-lun in 1900 and 1906–08 had proved the difficulty of reconciling Johnson's supposed route with the actual topography. An important light is thrown on the problem by a passage in the late Sir H. Trotter's report on Kishen Singh's route in 1874, which states that the writer had learnt from Johnson himself that one of the fixed points on which his whole work was based proved to have been incorrectly plotted on his plane-table, thus throwing out the whole of his topography. This is confirmed by a letter of General Walker's which explains how the published map of Mr. Johnson's journey was a corrected version entirely different from the original plane-table sketches (which unfortunately have not yet been found). It is therefore quite intelligible that a map compiled in this way should not agree with the reality. Major Mason concludes that although Johnson honestly thought he had climbed E 61, he was not even on the range which contained it, from which he was separated by the deep valley of the Yurung-kash river. Sir Aurel Stein agrees with this, but not with the further suggestion that the Zokputaran peak (22,639 feet) was the one climbed ; this, he says, would have meant a fortnight's arduous travel from Johnson's camp at Haji-langar, which Sir Aurel's knowledge of the ground has enabled him to satisfactorily identify. Major Mason defends the Indian Government from the charge of having under-valued Johnson's services, showing that some cognizance had to be taken of the breach of discipline involved in his undertaking the journey without leave, but that he was really treated with considerable generosity. He appears to have been a better triangulator than topographer, having done excellent work in the former capacity, while there is no doubt that he was a hardy and experienced mountaineer.

AFRICA

Vegetation Belts in North-Eastern Zululand.

An interesting account of a botanical trip in north-eastern Zululand, carried out by Messrs. Aitken and Gale under the supervision of Prof. J. W. Bews, has been printed as Memoir No. 2 of the Botanical Survey of South Africa (Pretoria, 1921). The area examined belongs to the first terrace or coast belt of Natal, its western boundary being the Ubombo mountains, broken by the gaps or "poorts" traversed by the Pongolo or Usutu in the north and the Mkutu in the south. The country falls steeply eastward to an undulating tract never above 500 feet, and this is succeeded by a belt of flat sandy country some 10 miles wide in which vleis and bogs are common. Towards the sea this belt is broken by lagoons, the largest being St. Lucia lake, which receives the Mkutu at its northern end and is fresh in its northern half, brackish in its southern. Where not sandy the soil is of the hard-baked type, but is capable of producing good crops if well cultivated. Rain falls chiefly in summer, but there is occasional rain in winter, especially along the coast strip. During summer the heat is excessive. The main vegetation types are: (1) Thorn

Veld, nearly everywhere where the soil is not sandy, corresponding closely with the similar type in Natal. *Acacia spp.* are the dominant trees, chiefly at the foot of the mountains and near rivers; their spread is checked by the grass fires, especially in the more populated districts. (2) Bush Veld, beginning north of the Munywane river, growing on dry sandy soil; the acacias here give place to a thorny scrub. (3) Sand Veld, in the sandy belt above mentioned, being grass-land dotted over with the "ilala" palm (*Hyphæne crinita*); in places other trees have established themselves, thanks to the constant presence of underground water, growing up in the shade of the ilala palms, which they eventually kill by shading them. (4) On the shores of lakes, a narrow strip of bush, with *Eugenia cordata* or *Terminalia sericea*, and next the water the cosmopolitan *Phragmites communis*. (5) Forest, in limited areas towards the north, probably sub-tropical in its composition. In one of these areas a species of *Raphia* probably nearly allied to *Raphia vinifera* was discovered; its fibre might be valuable commercially. (6) Strand vegetation, similar to that further south, illustrating the principle that strand-plants are widely distributed. Fruits of *Entada scandens* were seen washed up by the waves. (These are sometimes found on the Irish coasts, see *Journal*, vol. 57, p. 307.) Of the species recorded 44 per cent. occur also in Tropical Africa, while the affinities with the flora of the northern Transvaal suggest that this component of the Natal flora has migrated south along the border of Portuguese territory.

AMERICA

The proposed Erie and Michigan Canal.

We have received from Prof. C. R. Dryer the reprint of a paper read by him before the Association of American geographers and printed in the *Annals* of the Association for 1920, describing the remarkable natural trough which runs south-west for 420 miles from Lake Erie to the Ohio by the valleys of the Maumee and Wabash rivers, and discussing the projects set on foot for its partial utilization for a canal to connect Lakes Erie and Michigan. This great trough seems formed by nature to be a line of communication, and as such it has been largely used in history. From the Erie end the bottom rises 177 feet in 102 miles to a flat col at Fort Wayne, Indiana, and thence falls 439 feet in 318 miles to the Ohio end. Prof. Dryer begins by discussing the physical history of the trough, which may possibly have been traversed by a tertiary stream carrying the water of the Erie basin towards the Mississippi, but of this there is no conclusive evidence. The section now occupied by the Wabash (a tributary of the Ohio) was, however, in any case made by a pre-glacial stream comparable in age and volume with the lower Ohio, whilst the other half—that now occupied by the Maumee, flowing into Lake Erie—is chiefly the product of glacial and post-glacial drainage which extended headwards as the ice retreated, culminating in a succession of ice-dammed lakes and finally reversed by the eastward outflow of Lake Erie. In the history of the trough as a link between the Great Lakes and the Mississippi there have been two periods of special prominence—the canoe period, before 1783, when it was a great highway for Indians and white explorers, traders, and military forces; and the canal-boat period, in which, stimulated by the success of the Erie canal through New York, canal construction was taken up by the states of Ohio and Indiana, with the resulting opening of the Miami and Erie and Wabash and Erie canals by the middle of last century. Although ruined by the advent of railways, the Wabash and Erie canal had in its day a profound influence on the trade and general economic conditions of the United States.

The modern revival of interest in waterways has led to the project for connecting Lakes Erie and Michigan by a barge or ship canal, and this in turn to a preliminary survey under the orders of Congress, followed by an elaborate report by Colonel John Millis. Prof. Dryer states clearly the topographic data bearing on the feasibility of the project and sums up the case for and against it. He concludes that the tonnage to be carried is enormous and likely to increase, and that the scheme has claims to serious consideration. The canal would form a supplement and analogue to the New York barge canal, and its construction would be free from unusual engineering difficulties. The geographical conditions are too favourable to be ignored and may ultimately decide the question. The paper is accompanied by large-scale maps of the Wabash trough, showing in detail the nature of the ground throughout, but in the absence of a key it is not at first easy to piece them together correctly; whilst the general maps are so much reduced as to be with difficulty legible.

GENERAL

Memorial Service for the late Sir Ernest Shackleton.

So soon as it was decided that the body of Sir Ernest Shackleton should be taken back from Monte Video to South Georgia for burial, the President R.G.S. arranged with the Dean of St. Paul's for a Memorial Service, which was held in the Cathedral on Thursday, March 2, at noon. There were present representatives of the King, Queen Alexandra, the Prince of Wales, and the Duke of Connaught; Lady Shackleton with her children, and other members of the family; the President, with many members of Council and Fellows of the Society, including Mr. Rowett; representatives of the Admiralty, War Office, Colonial Office, and Air Ministry; representatives of many Embassies and Legations in London; several who had sailed with Sir Ernest on former expeditions; representatives of the many associations and institutions in which he was interested; and a very large number of personal friends.

Old Bindings in the Society's Library.

From the outset the Society's Library has been formed with a view to practical utility rather than show, and it is therefore by no means rich in old bindings of interest. Such as it contains have been acquired by accident more than of set purpose, in the cases where intrinsic importance has been happily combined with fine appearance. A small collection of such bindings has been brought together in one of the glass cases in the museum, and a few notes on them may be of interest. One of the oldest is probably the Strassburg Ptolemy of 1520, presented to the Library by the late Lord Peckover in 1905. The covers are of contemporary dark brown calf over wooden boards, blind-stamped, the centre panel being divided, as in so much work of the time, by three-line fillets into lozenge-shaped compartments stamped with a conventional ornament. Although the general style closely resembles that of English sixteenth-century binding, the actual stamp within the lozenges seems most nearly matched in a Dutch binding shown in the collection of rubbings in the Victoria and Albert Museum. Of the old stamped pigskin bindings which had so great a vogue in the fifteenth and sixteenth centuries the Library includes several examples from Germany, *e.g.* the second edition of the famous "Nuremberg Chronicle" (1497), and the collection of travels brought together by Sebastian Franck von Wörd (1567). Within a triple border of renascence ornament interspersed with small medallions, etc., the two covers of the latter show respectively emblematical figures of Justice and Chastity (the first with

sword and scales, the second represented by Lucretia stabbing herself), which appear to have been favourite panel-stamps of German binders of the period. Almost but not quite identical stamps adorn the covers of a book bound by Philippus Hoffoft (or Hoffott), of which a reproduction is given in Gruel's 'Manuel . . . de l'amateur de reliures'; and are to be seen also, without binder's name, in the collection of rubbings at the Victoria and Albert Museum. Another fine blind-stamped binding covers a book which is itself of great interest from its rarity—an old Danish sea-book of 1568 (see *Journal*, vol. 58, p. 318). The decoration here takes the form of bands of renascence ornament, the centre being formed of crest-work practically identical with that used for the outer border of Franck's book above mentioned. This seems to be a feature of German work, but as another example from Copenhagen appears in the Victoria and Albert collection, the binding, like the book, may possibly be Danish, especially as we are informed by Dr. J. Knudsen that similar ornament is to be found in contemporary bindings in the Danish Royal Library.

Of somewhat later bindings with gilt tooling there is an attractive example in the edition of Ortelius of 1579, presented to the Library by Mr. Yates Thompson. Its characteristic feature is the fan-shaped ornament in the centre and corners which occurs somewhat frequently in Italian bindings of the seventeenth century. The vellum-gilt bindings which had so great a vogue in Holland in the seventeenth century, especially for the great atlases of Blaeu and others, are well represented by Pontanus' History of Amsterdam of 1611. The ornament is the conventional scroll and strap-work also used lavishly for the decoration of engraved maps of the period. Of the French eighteenth-century bindings, a striking example is that of a copy of Le Brun's voyages (Amsterdam, 1718), the two folio volumes of which bear, within an ornamental border, the arms of a well-known "Femme bibliophile Française," the "Princess Palatine," Charlotte Elizabeth of Bavaria, who married Philip Duke of Orleans in 1671, and died in 1722. The ornament consists largely of oak-leaves, used also in one of the book-stamps of Louis XIV. Another, but less-known, armorial book-stamp is found on the covers of a work by Verdun de la Crenne and others (1778) describing a voyage by order of the French king for the testing of methods of determining latitude and longitude. The arms, together with the collars of the three orders (Saint Esprit, Saint Michel, and the Toison d'or or Golden Fleece) with which they are surrounded, shows it to have been almost certainly the property of the Comte de Montmorin de Saint Hérem, a French statesman of the time preceding the Revolution. The leather is the old smooth crimson Morocco, the beauty of which is well brought out by the absence of any decoration apart from the coat-of-arms in the centre. Lastly, an attractive specimen of French eighteenth-century work is supplied by a small Dutch atlas dating from the end of the sixteenth century, said to have been bound by one of the well-known family of the Padeloups, about 1740. It is also in crimson morocco, bearing a conventional ornament in the centre on an inlay of dark green. This volume was presented to the library by the late Sir Henry Bulwer.

OBITUARY

Viscount Bryce, O.M., F.R.S., etc., etc., etc.

THE death of Lord Bryce, who passed away at Sidmouth on January 22, without any previous illness, removes another of the most distinguished survivors of the Victorian Age. Though in his eighty-fourth year Lord Bryce was up to the last in the fullest possession of his habitual activity both of mind and body. His energy and zest in all he undertook—and he was always ready for fresh undertakings—remained unimpaired ; he was in every sense so full of life that his friends could not but flatter themselves that his days might yet be considerably prolonged. His death, consequently, despite his years, came as a shock to those who knew him most intimately. In his own country and throughout our great Dominions it has been recognized as a sensible public loss, while beyond the Atlantic it will be felt at least equally, and perhaps even more widely. Lord Bryce's name was a household word in the United States ; he had made himself a living link between their people and Great Britain. Should a world-peace spring out of our present troubles he will be held in perpetual remembrance as one of the chief agents in creating mutual understanding and goodwill between the two great English-speaking Commonwealths in whose accord and united action lies the best hope for the future of civilization.

Diplomacy, however, if in the public eye the most conspicuous, was only one amongst the many pursuits in which Lord Bryce's strenuous energies found a field. When late in life he took it up, he had long attained a very high position both as a statesman and historian. To these more serious occupations he had added the activities which brought him directly into connection with Geography : he had proved himself an indefatigable traveller, an eager mountain climber, and a keen botanist. It is with this aspect of his life rather than with his literary and political career that we are concerned here. As to the latter, we must be content to set out barely a few leading facts.

Educated under his father, who was headmaster of the High School at Glasgow, James Bryce went up to Trinity College, Oxford, and after taking a high degree and carrying off many honours, was in 1862 elected a Fellow of Oriel. In 1863 he attended a course of Law lectures at Heidelberg. In 1864 his prize essay on the 'Holy Roman Empire' was published in book form and shortly obtained a European success. In 1867 he was called to the English bar, at which he practised for some years. But when in 1880 he obtained a seat in Parliament, he turned from law to politics, and, having made his mark in the House of Commons, served at intervals between 1886 and 1897 in several Liberal Ministries, first as Under-Secretary for the Colonies and afterwards with cabinet rank as Chancellor of the Duchy of Lancaster, President of the Board of Trade, and finally in 1905 as Chief Secretary for Ireland. From 1870 to 1893 he was kept in touch with his own University by holding the post of Regius Professor of Civil Law ; in after years he received a multitude of Honorary Degrees from other Universities both in England, the United States, and on the Continent.

In 1907 Bryce was amid universal approval appointed H.B.M.'s Ambassador at Washington by Sir Henry Campbell Bannerman. He held the post for six years with the greatest distinction. On his return he was created a Viscount and subsequently received the Order of Merit. During the war he was appointed Chairman of a Committee on "Alleged German Outrages," and in 1917 Chairman of a Conference to consider the Reform of the House of Lords.

An unrecorded incident in Lord Bryce's life may perhaps find place here. At some date in the 'seventies the then Crown Princess of Germany applied to Dean Stanley to recommend an English scholar who might furnish her eldest son with sound views on Constitutional Law and History. The Dean suggested Bryce, who was communicated with and asked to consider the post. But some months later a message came from Berlin that the plan must be given up. What, if any, might have been the effect on the Ex-Kaiser's career had it been carried out remains a matter of curious speculation!

If the main occupations of Lord Bryce's life were historical studies and public affairs, he was brought by many of his minor interests into close contact with practical and scientific geography. He had not only an extensive curiosity but, as he says in the Preface to his 'Transcaucasia and Ararat,' a "special taste for geographical observation." Bryce's delay in joining our Society arose not from any lack of sympathy, but from a feeling that it ought to have been differently framed. He would have preferred the members to have been divided into two classes: *Fellows*, consisting of serious travellers and geographers, and *Members*, who joined from an interest in geography and discovery. The idea is one that has been mooted at various times during the last fifty years. It might in founding a new Society have a good deal to be said for it, but the practical difficulties in altering our constitution have hitherto seemed to the Council insuperable.

On his return from Washington Lord Bryce recognized the services the Society was rendering to the nation in the Great War, and he became a frequent visitor and speaker at our Meetings, so that during my Presidency the Council gladly took an opportunity of adding his name to the very small and select list of Honorary Members. Had he joined the Society earlier in life he would inevitably have been numbered among our Presidents, and he would have filled the post admirably. While he was President of the Alpine Club, 1899–1901, it was a frequent source of amusement to the members that whatever distant range the paper read might refer to the Chairman was always able to illustrate it by his personal experiences in the same region.

His long life gave Bryce adequate opportunity, despite his political ties, for extensive travel. Any attempt to make a complete catalogue of his journeys might be rash, but with the kind help of Lady Bryce, who shared his tastes and was for many years his constant companion, a list which may furnish some idea of their extent is here put together.

Early in life Bryce roamed much in the Pyrenees, the Dolomites, and other parts of the Alps. Among his climbs were the Maladetta and the Vignemale, the Pelmo and the Terglou, Monte Rosa and the Schreckhorn. He wandered with Sir Courtenay Ilbert to Iceland and ascended Hekla, to Transylvania and the Carpathians with Sir Leslie Stephen. In Europe he went as far north as the Lofoten and the North Cape, and besides the central countries, France, Germany, Switzerland, Russia, Austria, and Italy, had visited Spain and Portugal, Greece, Troy, Constantinople and the whole Balkan Peninsula, Sicily, Corsica, and Majorca. In North Africa he knew Morocco, Tunis, and Egypt; he had journeyed, often in bullock-carts, over most of South Africa and the Transvaal. His travels in Asia included Palestine, Armenia (of which he was for many years the champion), Transcaucasia, Siberia, China, Japan, India. Of North and South America there were few parts he was not familiar with; his wanderings extended from the Canadian Rockies and Vancouver to the Straits of Magellan. At Washington he was reputed to be the only man who had been in every state of the Union. The West Indies and Mexico were the object of a

special journey. Another took him to Hawaii and Samoa and on to New Zealand, Australia, and Tasmania. Whether at home or abroad he was as keen in acquiring knowledge as ready in pouring it out. Sir Lambert Playfair, who was Consul-General in Algeria while Bryce was at the Foreign Office, used to describe what a rare and agreeable experience it had been to him to meet an Under-Secretary who really knew something, and wanted to know more, about the country where he had been posted. Sir William Harcourt is reported to have revealed as a Cabinet secret "when we want to know anything we look it up in Bryce."

The Geographical Society has numbered among its Fellows, and justly honoured with its Awards, many hardy African explorers and Polar navigators, adventurers who took their lives in their hands in the quest of discovery and romance. Lord Bryce represented a different but not less valuable type, the traveller who pursues Nature with a keen eye for her beauties and an equally keen interest in the influence of their physical surroundings on the lives and fortunes of the peoples he visits. His alert and versatile mind picked up fresh information at every turn and from every chance encounter. He was gifted with a rare talent for setting in order and putting before the world in a form suited to catch the public ear the store of information thus accumulated. He habitually threw into his pages something of his own zest, and thus succeeded in keeping his readers' attention alive for the more serious matters he sought to bring to their notice. His vast knowledge of history and institutions and his very wide experience of travel gave added value to his observations and greater clearness to his vivid impressions.

If travel filled a large place in Bryce's life and interests, there was one branch of it to which he was particularly addicted. In 'Who's Who,' where we all make our confessions, he set down as his special recreation 'Mountain climbing.' He had a Scotsman's passion for anything in the shape of hills, from his own Highlands (which he vainly endeavoured by his 'Access to Mountains Bill' to render more accessible to the Public) to the snows of the Himalaya and the Andes. When his companions failed 5000 feet below the summit he ventured alone to the top of Ararat (17,000 feet), a feat of singular hardihood. Wherever he went he climbed any heights within reasonable reach: Table Mountain at the Cape, Machaca in Basutoland, Mauna Loa in Hawaii. He kept up his enthusiasm and energy to the last. As late as 1913 he made a long excursion from the Trans-Siberian railway in Russian postcarts in order to get a glimpse of the Altai. Two years ago he was to be found scrambling among the heights behind Montana in Canton Valais, or strolling in face of the Pennine snows and quoting line after line of Homer while discussing the sentiment for Nature among the Greeks.

Lord Bryce had become a Fellow of the Royal Society in virtue of his Cabinet Office. But he had also definite scientific interests. While careful to observe and compare the geological and general physical aspects of the countries visited, he had a particular affection for botany. His first publication (in 1859) was a 'Flora of the Island of Arran.' From his visit to South Africa he brought back fifty-four specimens, eleven of which were pronounced at Kew to be plants new to science. On his walks round his Sussex home he would frequently halt to pounce on some insignificant flower which had strayed from a more northern habitat. In a letter written a few days before his death he mentioned among his Agenda the compilation of a 'Flora of Ashdown Forest.' At the same time he was at work on a collection of 'Memories of Travel,' which it is to be hoped may be sufficiently advanced to admit of publication, and had in contemplation a visit to Rome for material for a work on Justinian!

Bryce's two most important works were 'The American Commonwealth,' 1888, and 'The History of Democracy,' 1921. In the former he proved that it was possible to present to the citizens of the United States criticisms of their Constitution in a form that would be accepted as both honest and friendly; in the latter he showed himself able to weigh the merits and imperfections of democratic institutions with a singular impartiality. The volumes in which he has recorded his travels are 'Transcaucasia and Ararat,' 1877, 'Impressions of South Africa,' 1897, and 'South America: Observations and Impressions,' 1912. Of these the first, in which the author tells in picturesque detail the story of his solitary climb on Ararat and plays pleasantly about the legend that plants the Ark on its summit, is perhaps the liveliest. In South Africa he was largely concerned with the problems and politics of the period immediately preceding the Boer War. The third volume combines the attractions of a Picturesque Tour with an encyclopædic summary of the physical features and political conditions of half a continent. It was sometimes alleged that Bryce was too much of an Oxford Professor for the House of Commons. There is nothing of the Professor in the varied pages of these works of travel; they are the spontaneous outcome of the mind of a lifelong student of men and politics, who was also a quick observer and ardent lover of Natural Beauty in all its forms.

In conversation Lord Bryce was a most entertaining and stimulating companion. For any information he succeeded in drawing out—and he was always in quest of it—he was wont to repay the giver with compound interest. His natural kindliness and simplicity, his interest in all about him, people as well as places and institutions, his readiness to be of service not only to his friends but to any one with whom he came in contact, added charm and grace to a width of knowledge which, as we have noted, was like Solomon's in this respect, that it extended from the cedar in Lebanon—or rather in the Yosemite Valley—to the hyssop on the wall. He went through life setting an example of indefatigable energy, physical as well as mental, and giving encouragement and aid in their several pursuits to two younger generations. He recently told an acquaintance that the only way to stave off old age was to go on working, and warned another, almost his contemporary, that "he was too much inclined to rest on his oars." The gap his loss creates is the measure of the place he filled in the lives and hearts of the many friends he leaves behind him, both in the Old and the New World.

DOUGLAS W. FRESHFIELD.

Robert Logan Jack, LL.D., F.G.S., M.I.M.M.

We much regret to record the death, which occurred in Sydney, N.S.W., in November 1921, of Dr. R. Logan Jack, distinguished not only for his extensive contributions to our knowledge of Australian geology, but also as a keen explorer, both in Australia and China, whose work has been of distinct geographical value.

Born in Irvine, Ayrshire, in 1845, Jack studied at the University of Edinburgh, but being interested in natural science was appointed to the Geological Survey of Scotland in 1867, remaining on its staff till 1876. In 1877 Mr. Jack was appointed Government Geologist of North Queensland, and in 1879 of the whole of Queensland. During the twenty-two years he spent in the service of the Queensland Government he traversed the colony from end to end in the course of his geological investigations, doing work that in a new country combined with it the duties of an explorer, a geographer, and a cartographer, and involved difficulties and risks beyond the ordinary. For example, in 1879

and 1880 he led a small exploring and prospecting party along the eastern side of Cape York Peninsula from Cooktown to Somerset—the first expedition to traverse the peninsula on its eastern *versant*, where, in addition to great natural obstacles, the hostility of the aborigines was constantly in evidence.

Subsequently, in 1881, after traversing the west of Queensland in connection with a proposal made by a syndicate to build a transcontinental railway on a land grant basis, he pointed out that this region was an artesian basin. The development of this basin, since proved to be the largest in the world, that followed on his recommendations, has added immensely to the pastoral wealth of Queensland.

In 1899, when Mr. Jack was in London, the University of Glasgow conferred upon him the degree of LL.D., in recognition of his scientific work in Queensland. Resigning his position as Government Geologist in that year, Dr. Jack went to China to investigate the mineral wealth of Szechuan on behalf of an English syndicate, being accompanied by his son, R. Lockhart Jack, and Mr. J. F. Morris. Forced out by the Boxer rising of 1900, he led his party across some of the least-known parts of China to Bhamo in Upper Burma. On his return to London he lectured before the Royal Geographical Society (of which he had been a member since 1877) on the country traversed (March 1902). Returning to Australia he was appointed as a Royal Commissioner to investigate the Collie coalfield and carried out an exhaustive investigation of the field, its prospects, and the commercial utilization of its coal.

An authority on Queensland mining and geology, Dr. Jack wrote, in addition to some 145 published official reports and maps, a 'Handbook of Queensland Geology' (1886), 'Mineral Wealth of Queensland' (1888), and, in collaboration with the late Robert Etheridge, Junior, the 'Geology and Palæontology of Queensland and New Guinea' (1894). The authors were awarded the Clarke Memorial Medal of the Royal Society of New South Wales in the ensuing year.

In 1904 Jack brought out an interesting narrative of his Chinese expedition under the title 'The Back Blocks of China'; and just before his last illness he had completed a work in two large volumes ('Northmost Australia') containing a critical examination and coordination of all the explorations in and around Cape York Peninsula during the last three centuries. This we hope shortly to review in the *Journal*.

In an appreciative notice which appeared in the Sydney *Daily Telegraph* on November 11 last, Sir Edgeworth David summed up his work and character as follows: "We have lost one of the most distinguished Australian geologists, a great and intrepid geographical explorer, most firm of purpose, a charming writer, and a man above all of singular unselfishness, patience, and sweetness of character, qualities which endeared him to all with whom he came in contact."

CORRESPONDENCE

Routes in Middle Arabia.

M. CASANOVA'S pamphlet 'Une Mine d'Or au Hidjaz,' on which a note appeared in the *Geog. Journal* of February, deals curiously enough with perhaps the least-known portion of middle Arabia. Ancient routes seem to have followed lines very different from the modern, and although our knowledge of the heart of Arabia has grown enormously during recent years, many of the old lines of communication—the Pilgrim routes—still lack confirmation by modern travellers. Hence a remarkable lack of corroboration of the itineraries of the early

Moslem geographers. We have better maps of the very heart of the peninsula than of the regions adjacent to Medina and Mecca. The main lines of communication between the Holy Province and Jebel Shammar, *en route* to Mesopotamia, are still unknown except for the route marches described by Ibn Khordadbeh, Yakut, Bakri, Mukaddasi, Ibn Rustah, etc. M. Casanova has attempted to interpret these in order to locate the gold-mine. Since he quotes Huber and Doughty and relies upon their surveys of certain localities, I should like to draw his attention to the new maps of the region under discussion, published by the G.S.G.S., scale 1 : 1,000,000, "Medina" and "Riyadh" (the latter now in proof stage and shortly appearing). On these sheets he will be able to follow a complete replotting of Huber's surveys, adjusted to the most recent fixed positions. He will find certain sure bases for calculation. Samira, for instance, is now correctly placed. Hajir is probably correct within a mile or two, and therefore the Wadi Rumma in its central course. In this district Casanova's *Djabal Firs* of Yakut must be J. Fèrs of Huber's 1880 journey, situated near to Dhraghrath on the edge of the Harrat Ethnan.

M. Casanova seems to have missed Guy Le Strange's recent publication, 'Mustawfi's Nuzhat al Qubūb' (Gibb Memorial, **23**, II., 1919). The route described on p. 164 is worth his consideration. "Samira [now a fixed position] to Hajir, 36 miles"; it is 37 miles on the "Medina" 1/M sheet. "Hajir to Mádan Nuqrah (Silver Mine) 34 miles," brings one to the point where the routes bifurcate to Medina and Mecca. I recommend the rest to his unrivalled knowledge of the ancient geography of the region.

DOUGLAS CARRUTHERS.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1921–1922

Ninth Evening Meeting, 6 March 1922.—The President in the Chair.

ELECTIONS.—James Robert Ainslie; Capt. H. M. Arnold; Ernest Ancell Basden-Smith; Lieut. J. S. Blunt, R.A.; Capt. J. Edward Brooks, R.A.M.C.; Miss Clara Frances Browne; Miss Sybil Adela Campbell; Frank Coop; A. S. I. Elliott; Capt. Fazl ud Din, I.M.S.; Lieut. Angus Cunninghame-Graham, R.N.; Capt. A. B. Hodgson; Jim Boon Hugh; Capt. Edward H. O. Keates, M.C.; Rev. Evan Mackenzie; Walter Merefield Meredith, M.A.; Major William J. Lyndon Norwood; John Maurice Pearson; Sir John Stewart, Bart.; Miss Elizabeth H. Tate; Dr. J. Monroe Thorington, A.M.; Miss Dora Julia Wayland; Capt. W. H. Wynne-Finch.

PAPER: The Influence of its Geography on the development of London. C. E. N. Bromehead.

Tenth Evening Meeting, 20 March 1922.—The President in the Chair.

ELECTIONS.—Capt. Humphrey St. John Carruthers; Henry Cautley Comber; Miss Annie Home; Lieut. R. E. F. Laidlaw; Major John Tom North; Kenneth Boyd Potter; Lady Slade; Frederick Williams.

PAPER: The Geography of the Treaty of Rapailo. Harold Temperley.

Fifth Afternoon Meeting, 13 March 1922.—The President in the Chair.

PAPER: A description of the Regional Survey of the Croydon Natural History and Scientific Society. C. C. Fagg, President.